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# PROCEDURE IN PRELOADING

**Under the title, "Progress in Preloading" (Vol. 73, p. 545), T. C. Delaval-Crow traced the history of ball-bearing spindle mount design. The present article, which discloses what happens in a bearing under preload, forms a logical sequel.**

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FOR years, ball bearings have been successfully employed in drill spindles, gear boxes, countershafts, pulleys, and other positions where speed-ability and load-carrying capacity are essential. Because of the satisfactory performance obtained in these services, attempts were made by machine tool builders to adapt these bearings to parts requiring greater accuracy of support. That the results obtained with many of these early applications fell short of anticipations is not at all surprising when the circumstances surrounding the applications are reviewed in the light of present knowledge.

To provide sufficient film area for the support of heavy loads, sleeve bearings were made long and their total length determined to a large extent the overall proportions of a machine. The combined length of these bearings accounted for a considerable part of the length of a spindle and contributed in no small degree to its rigidity. To facilitate assembly and to gain accessibility, sleeve bearing housings were nearly always of the split type. In reworking or changing existing equipment to utilize ball bearings, not only were spindles too slender and housings too light to prevent serious deflection, but the general design of frames and associated parts was seldom adaptable. Ball bearings, made to standardized limits of accuracy, were not wholly acceptable for extreme precision work. In numerous instances, not only were the bearings applied without sufficient thought for the natural deformation under load, but frequently types of bearings were employed whose load characteristics rendered them entirely unsuited to precision spindle applications.

Today, ball bearings are manufactured in types and sizes especially suited to precision work and are made to the most exacting limits. Bearing manufacturers have developed improved methods of application which assure a high degree of rigidity and satisfactory assembly methods. In line with the trend toward higher speeds and increased rigidity, machine tool builders are producing machines proportioned expressly for the installation of ball bearings.

When a bearing of any kind is placed under load, a certain deformation takes place in the parts directly supporting the load. This deformation, translated into terms of deflection, becomes a movement or displacement of the supported shaft from its normal position. In an angular contact ball bearing of the type used for precision spindles, the rate of deflection, by reason of the shape of the contacting parts and the laws governing their elastic deformation, shows a marked decrease with each additional load increment. This characteristic is indicated in the deflection curve, Fig. 1, which is for a light series, 100 mm. bore bearing. The development of this curve remains fundamentally the same for a range of bearing sizes provided the type and internal construction are unchanged. This curve shows a comparatively rapid initial rate of deflection during which the bearing parts are thoroughly seated and the balls and raceways more closely approach a common curvature. If this initial

period is eliminated by means of an internal force or preload applied as pure thrust, subsequent deflection, caused by an external load, will be very small.

The principal effects of preloading upon the rigidity of a spindle may be shown by means of an installation employing bearings of the type and size for which a deflection curve has been given. Where two bearings are opposed under a preload at the front end of a spindle, as in Fig. 2, and an external work load is then imposed, the front bearing does not carry the working load plus the original preload. Let it be assumed that sleeve *B* is moved toward the rear of the spindle by the preloading nut *N* to such an extent that an internal load of 3,000 lb. is imposed on the bearings. This means that the spindle between the bearings is in tension by a similar amount

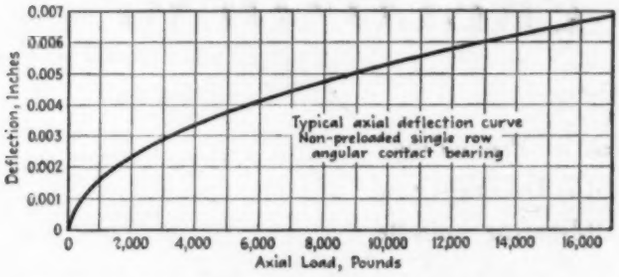


**Fig. 1—An initial rapid rise in deflection occurs when a ball-bearing spindle is loaded. By absorbing this portion of the curve, preloading promotes rigidity**

and that the bearings have each been deflected a definite distance. Now let an external thrust load of 2,500 lb. be applied to the spindle. This additional load causes a slight increase in deflection of the front bearings but at the same time decreases the spindle tension, partially relieving the preload on both bearings. Therefore, the front bearing is carrying less than the sum of the external and internal loads, and the rear bearing is carrying less than the original preload.

This load distribution and the total axial deflection, caused by the external load, may be graphically determined by use of a portion of the deflection curve previously illustrated. Since the rear bearing has been relieved of some preload by the deflection of the front bearing, it follows that this bearing must have partially resumed its original shape and substantially at the same rate at which it was deflected. By taking the sum of the two loads and following back the inverted and shifted deflection curve *D* (Fig. 3), the point of stability is reached at the intersection with the original curve, which is found to correspond to a load of 4,400 lb. for the front bearing. Since the preload relief is the same for both bearings, the relief *R* must be subtracted from the original load on the rear bearing giving for this position a total of 1,900 lb. In all cases, the difference between the loads on the front and rear bearings will equal the external load. In the example given, it will be observed that the total axial deflection under the work load mentioned amounts to 0.00057 in.

Since preloading is very effective in the reduction of spindle deflection, the question may well be asked as to over what range of external loads a given preload might be expected to exert an influence. When the preload of 3,000 lb. was imposed in the case just cited, both bearings were equally loaded and were, therefore, compressed or deflected an equal amount. Reference to the curve, Fig. 1, shows that the deflection in each bearing, due to this initial load, amounted to 0.0029 in. To render the preload entirely ineffective, it would be necessary to subject the front bearing to a thrust load great enough to cause an axial deflection in that bearing of twice 0.0029 or 0.0058 in. It requires a load of 11,750 lb. to produce this deflection. In other words, the relieving load would have to be approximately four times as great as the preload.

Where extreme precision is the goal of the machine designer, there is little to be gained by the use of very accurate and rigidly mounted bearings unless the spindle itself is of sufficient diameter to assure an equally satisfactory degree of rigidity. Where a spindle is correctly proportioned, light series bearings are usually applicable, keeping the housing diameters as small as possible and yet giving enough bearing capacity to assure a relatively high factor of safety.

In the mounting discussed, the light series 100 mm.-bore bearings have a pure thrust capacity at 200 r.p.m. of approximately 19,000 lb.; therefore the use of heavier preloads and the application of much greater external loads would still leave a good factor of safety. As a matter of fact, it has been found that the amount of preload required to give adequate spindle rigidity in practically any service is so small in relation to bearing capacity as to have a negligible effect upon endurance.

Deflection, resulting from axially applied loads, has thus far been considered, mainly because it is so intimately involved in the principle of preloading. Deflection, under radial or combined radial and thrust loads, is more intricate and for actual working conditions must take into consideration such factors as diameter and shape of the spindle and the distance from the bearings to the point of load application. Various of these factors will be discussed later, but certain pertinent facts should receive mention here.

### Angularity and Rigidity

When an angular contact ball bearing is preloaded or where external thrust is applied, the load is resisted along the line of the contact angle and the balls and races are compressed in this direction. Since this contact angle changes little under different loads, and in spindle bearings, is much more radial than axial, more direct support with less deflection is obtained as the load becomes increasingly radial. Spindle loads are almost invariably made up of combined radial and thrust forces whose resultant more closely approaches the bearing contact angle than either pure thrust or radial. Working conditions are therefore most favorable to maximum rigidity.

Whatever means may be utilized to bring about the desired internal static thrust load upon the bearings, it

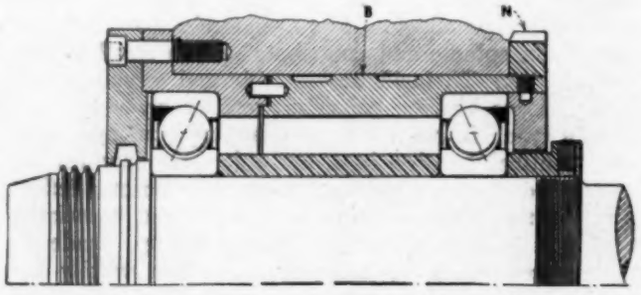


**Fig. 2—When two bearings are opposed, the preload and workload are not cumulative. In fact, the presence of the preload decreases the resultant**

should be one which embraces certain essential principles of ball bearing applications. In addition, other features desirable from the machine manufacturer's standpoint should be provided. Since rigidity is the first objective of preloading, the bearings must be applied so that radial play between bearings and housing, or bearings and spindle, may be entirely eliminated. Since the deflection characteristics of the bearings are known, preloading permits of an easy but reliable way of determining the amount of internal load.

After a spindle has been in use for a short time, it is often found that the mounting parts will work into a slightly firmer seat, that threads will stretch a little, and that the preload will be somewhat relieved. For this reason, it is desirable to adopt a preloading method by which the load may be altered quickly and without necessitating disassembly of the machine. After this settling or seating of parts, only one adjustment should be required.

The question of assembly must be considered. If this requires intricate maneuvering of parts or special skill, the cost may be materially increased. The facility with which a mount may be disassembled is often of no small

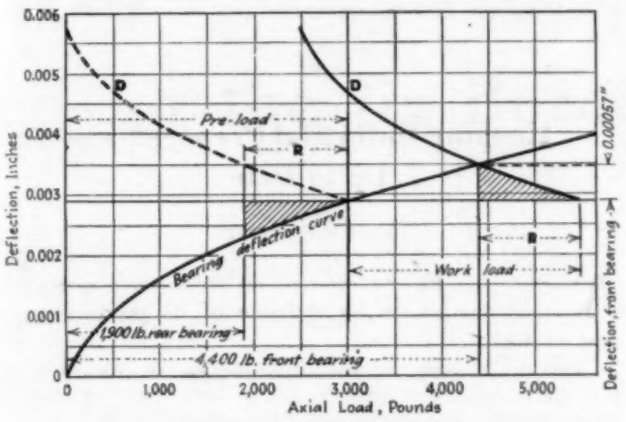


**Fig. 3 — The chart shows graphically how the initial preload actually reduces deflection under operating conditions**

importance. Frequently after a machine has been completely assembled, it is found necessary to make minor corrections to certain parts which may require removal of the main spindle to give ready access.

A method which admits all of the foregoing essentials and which has been worked out in principle for a great variety of spindle applications, makes use of adapter sleeves for the bearings. The lathe spindle, Fig. 4, is typical of this method and will serve to illustrate the advantages derived through the use of sleeves. These can be most clearly shown if the installation of such a spindle is followed in sequence of the major steps. All three sleeves are bored to take the bearings with a press fit, but the outside diameters are not alike, sleeve *A* being finished to give a press fit in the machine frame and sleeves *B* and *C* a snug push fit. When the sleeves are gaged, their high points of eccentricity are plainly

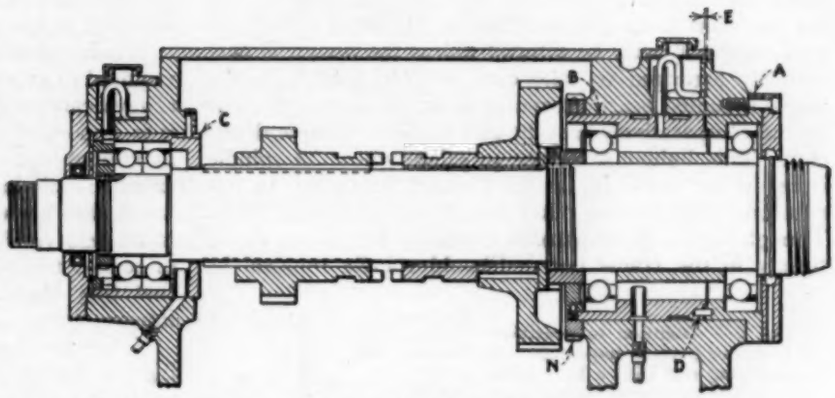


**Fig. 4—A typical mounting employs sleeves to permit adjustability and ease of assembly**

scribed. Since the outer rings of precision spindle ball bearings are similarly marked, the bearings are pressed home so their high points are diametrically opposite such points in the sleeves, insuring maximum running truth for the spindle. The dowel *D* prevents *B* from turning with respect to *A*, either before or after assembly, thus retaining the proper line-up.

Front bearings, in their sleeves, are assembled upon the spindle before introduction into the machine. Where gears or other parts carried on the spindle are small enough to pass through the front housing bore, the entire bearing and spindle assembly may be completed on the bench. In the present instance, this is not possible, because of the diameter of the large drive gear. Therefore, the spindle is brought to the machine minus the rear bearing assembly, and is simply pushed home until the forward sleeve shoulder is tight against the frame. Because *B* is push fitted, this is readily accomplished. Even if the fit of *B* should incline to the tight side, no harm would result, since space *E* (from 0.005 to 0.015 in.) would close up, and the sleeve would butt together moving into place as a single piece. Sleeve *C*, also push fitted, is carried into position when the bearing inner rings are pressed to a seat against the spindle shoulder by the adjusting nut.

### Applying the Preload

Preloading of the front bearings is accomplished by rotation of the nut *N* which pulls sleeve *B* to the rear, setting up the desired amount of internal thrust load. In regular practice, the bearing manufacturer furnishes the machine builder with such data as the amount of preload adequate for the work and the axial movement of the loading nut to give this static load. Conversion of this figure into circular movement of the nut enables any mechanic to make the necessary adjustments. The rear bearings are of the duplex type in which the outer rings are offset a certain distance from the inner rings before mounting. Clamping them tightly together produces sufficient preload for the rear position.

It is customary to apply ball bearings in the housing with a relatively easy push or sucking fit so that a gradual creep of the outer ring may continually bring fresh portions of the ball raceway into the area of highest stress. Such fitting cannot be employed where extreme precision is a prime requisite. In spindle applications, where preloaded angular contact bearings are used and where the load is more evenly distributed among the balls, tight housing fits are not detrimental to bearing

performance. With accurate spindles, where outer ring fits may run from line and line to 0.0004 or 0.0005 in. tight, assembly may be difficult unless the design is particularly arranged to take care of this point. In the sleeve mounted bearings, the problem has been overcome by the comparatively easy fit of the sleeve outside diameter. This lighter fit is not in effect when the spindle is ready for work, for as the preload is applied, an expansion of the bearing outer ring in sleeve *B* takes place. Though slight, this expansion is sufficient to fit the sleeve tightly in the frame bore. Should spindle removal be necessary, backing off the loading nut relieves the fit and disassembly may be achieved with the same facility as assembly.

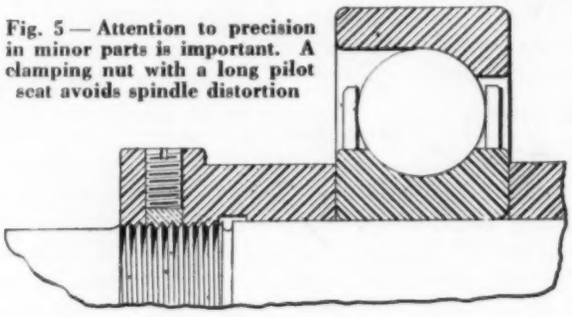

**Fig. 5 — Attention to precision in minor parts is important. A clamping nut with a long pilot seat avoids spindle distortion**

It might be assumed, where a spindle is being built for precision work, that all of the parts entering into its construction would be made with a special regard for accuracy. Very often this is not true, because of insufficient realization of the importance of such apparently minor parts as clamping nuts and spacers. There is often the thought on the part of the machinist that if the face of a nut does not run true with the threads, the play in the threads will allow it to line up well enough when tightened; that if the two ends of a bearing spacer are not quite parallel or square with the bore, the faces will straighten up under compression at assembly. All this might happen, but the effect upon the spindle may easily be great enough to influence its accuracy. Any out-of-squareness in a clamping member sets up a bending force when the parts are tightly locked. If several faces are off true and line up at assembly so as to multiply the errors, it is quite possible to deflect the spindle and impair its suitability for high-speed operation.

Various measures may be taken in the design of parts to enhance accuracy of mounting. One of these is to make clamping nuts long enough so that from one-third to one-half of the length can be bored to give a snug fit over the spindle, as in Fig. 5. If the clamping face is made square with the pilot bore and the fit of the threads is reasonably loose, a true, even clamping pressure will be obtained. This type of nut should be used where there are only two bearings on the spindle or for the front bearings, where more than two are employed. When a soft metal ear washer is inserted between the nut and bearing, accurate clamping is not always assured, since few washers are perfectly flat or uniformly thick. Standard locknuts and lockwashers of this kind do not permit of the piloting feature mentioned. Another design factor, influencing spindle rigidity, is the wall thickness of the spacer used between bearings. Cast iron is satisfactory, but whatever material may be used, the spacer must be made thick enough to withstand the comparatively high compressive force without bulging or buckling. If the spacer is to be under-cut or relieved through part of the bore, only enough material should be removed to insure a clearance over the spindle.

Where spindles are shorter and two bearings only are required to give adequate rigidity, the bearings are nearly always carried in separate housings. In such instances, it is important that the housings be so webbed that the maximum static load, tending to pull them together, cannot result in serious axial deflection. This does not mean that housings for relatively long spindles may be made less rigid, but that opposed bearings in separate or semi-detached housings usually require special care so that they may resist effectively not only external, but internal thrust loads.

While no special skill is required in preloading bearings, a certain technique should be followed to insure uniformly good results. This may be outlined as follows:

Make sure that the preloading nut fits snugly but without binding at any point in its rotation. Tighten the nut to approximately twice the distance required to give the initial load. While this is being done, an assistant should rap the spindle nose smartly with a babbitt hammer to bring all parts to a true, solid seat. The nut should be then backed off until free and tightened again without pounding until a definite resistance is felt. This is the point at which the bearing parts are just seated and at which actual preloading commences. Thereafter, the nut should be advanced only the distance calculated for the load. It is usually best to repeat the above process once or twice to check whether the nut stops at approximately the same preloading starting point or whether further seating of parts has taken place. When satisfied on this score, securely lock the assembly.

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## Keeping Industrial Preparedness Up to Date

JOHN R. GODFREY

AN ARMY officer blew into an automotive plant the other day to get an estimate of its production in case of war.

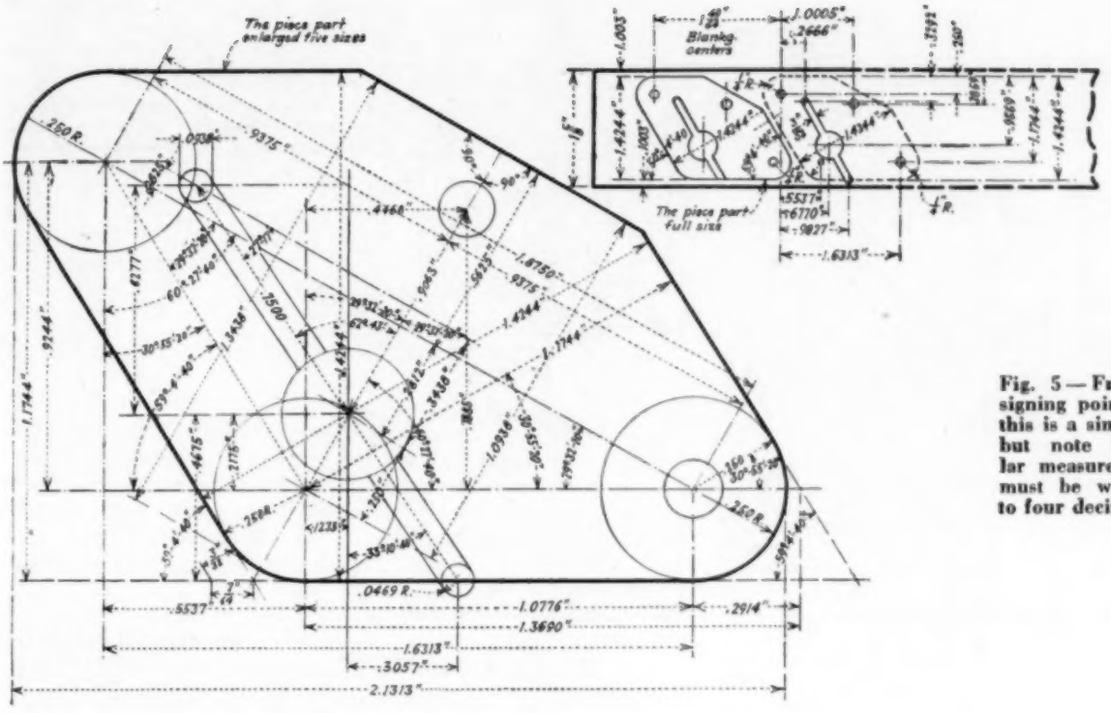
"Here," he said, "is a list of devices we would want you to build. We want to know how many we could count on per day after the first month."

After glancing over the list the production manager handed it back. "There's no use leaving that list here, Colonel," he said. "I haven't time to hold post mortems. I'm busy on present-day stuff."

"What do you mean, post mortems?" demanded the Colonel. "Those are the devices we need in case of emergency."

"All I've got to say, Colonel," replied the production man, "is that if your army depends on those devices, you're licked before you start. These devices are right in our line as you say, but we abandoned them anywhere from two to five years ago. If you were foolish enough to order them, I suppose we'd have to make 'em or be shot at sunrise. But I don't have to waste time figuring out capacity for something I know you wouldn't order."

All of which shows the necessity of having some one on the industrial preparedness staff, officer or civilian, who knows present practice and doesn't waste time asking estimates on equipment that is obsolete before the emergency arises.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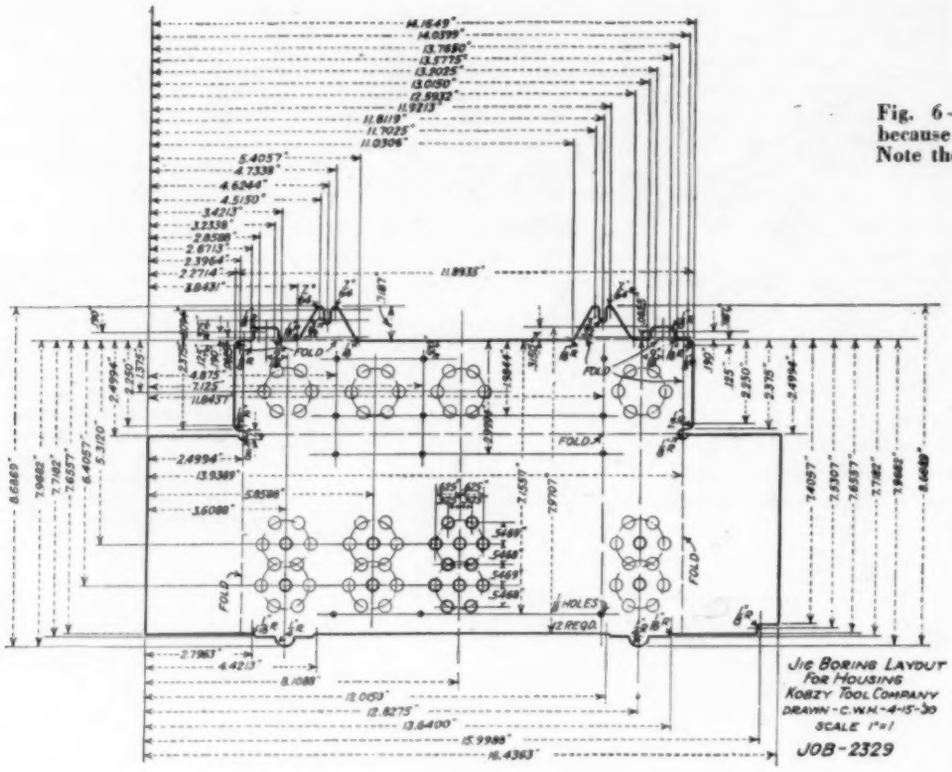



**Fig. 6 — A much simpler example because rectangular, with few radii. Note the clean cut appearance of the dimensioning**

**Fig. 7 — Each hole is dimensioned from zero. It would be practically impossible to lay this out without a variation error, by any other method**

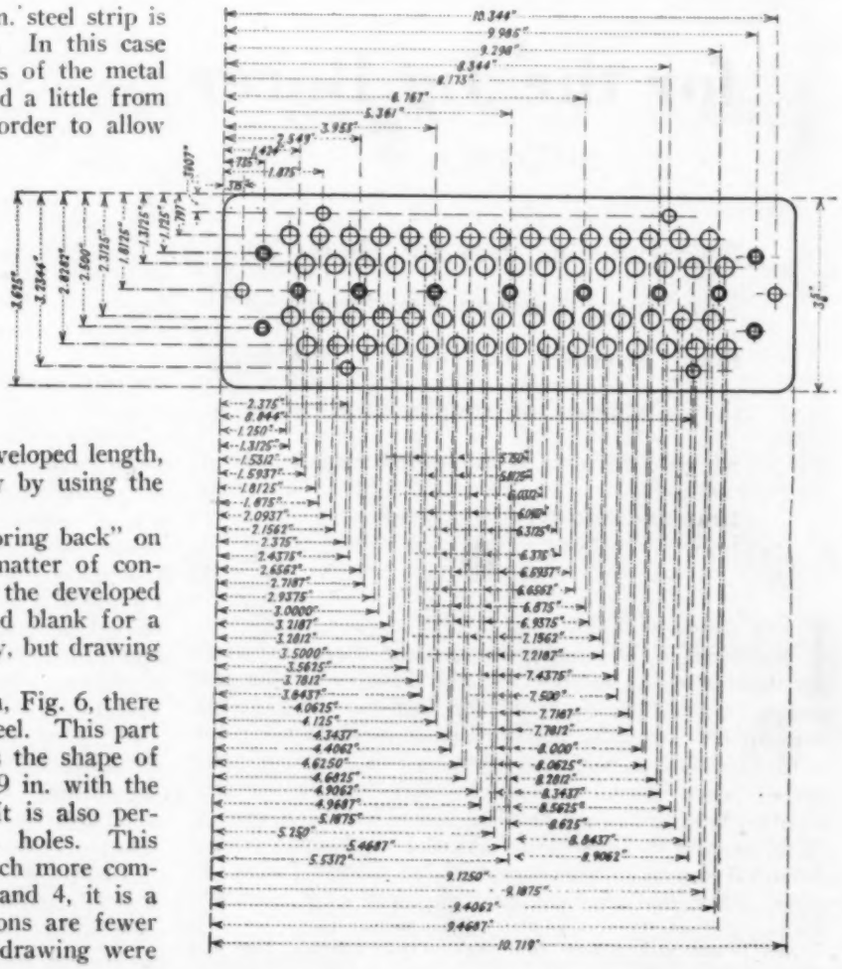
dimensions plainly. The blanking centers in this case, be it noted, are $1\frac{42}{64}$ inches.

The part itself is $\frac{1}{4}$ in. thick, and $1\frac{5}{8}$-in. steel strip is the nearest commercial size of material. In this case the usual side allowance of the thickness of the metal is not necessary. The stripper is relieved a little from the blanking step to the outlet end in order to allow for expansion of the material, and the narrower strip is easier on the press than full width would be, to say nothing of the saving in material.

The new technique in drafting applies not only to flat die work but to bent work also. No longer is it necessary for the diemaker to work backward and, by using thin strips in the unhardened bending die, arrive at the developed length of his blank. Some drawings did, and do, carry the developed length, but the draftsman sidesteps responsibility by using the word "estimated" or "approximate."

It is true that the exact amount of "spring back" on hard brass, copper or bronze is still a matter of conjecture, but that feature does not affect the developed length. It is true also that the developed blank for a drawn cup cannot be figured to a certainty, but drawing dies are not made on the jig borer.

In the next example under consideration, Fig. 6, there is shown a part made of 0.037-in. C.R. steel. This part has four bends, and when finished it has the shape of a rectangular box 11.437 x 5.156 x 2.499 in. with the ends closed, but with two open sides. It is also perforated with $72\frac{5}{16}$-in. and twelve $\frac{1}{8}$-in. holes. This layout was made full size, and, while much more complicated than the part shown at Figs. 3 and 4, it is a much simpler layout because the dimensions are fewer and the piece is larger. From this one drawing were



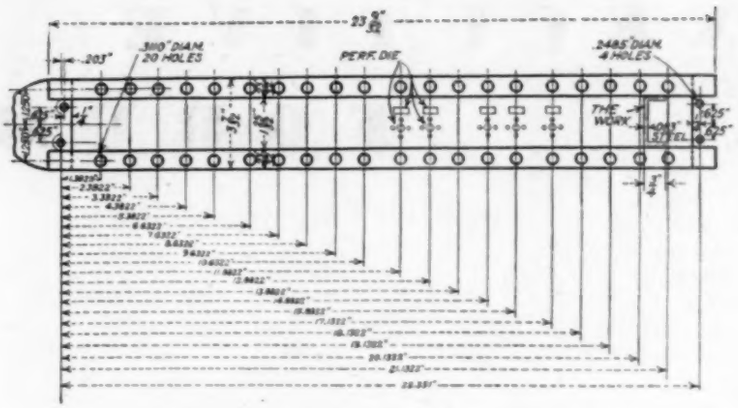
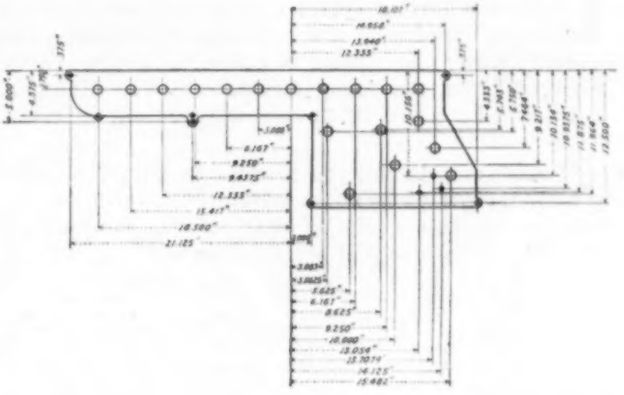



**Fig. 8 — A simple job, but requiring accurate layout**

**Fig. 9—An example of straight manufacturing. Ordinarily it would be necessary to button this part, or make a jig**



laid out the blanking, the perforating, and two forming dies. All of the four dies were made separately, but the registration was the same—the upper and left hand edges. It shows marked simplicity when compared with the part referred to in Fig. 1, which illustrates the cost incident to complicated design.

### Eliminates Cumulative Error

If redimensioning did nothing but force registration from one place for each direction, it would save enough time to pay for itself, but when, in addition, it eliminates the cumulative error caused by lack of common registration, it increases its usefulness tenfold. In laying out the drill jig cover shown in Fig. 7, where so many holes are in a straight line it would appear easier to give the distance of the first hole from the left hand edge, and then the center-to-center distance of the rest of the holes on the same line. It would be argued that this is the method of boring that would be followed by the operator on the jig borer. The argument is sound, but the psychology is not so much so. Using the cumulative method would not only take more time, but we do not believe one piece in five would come through without error. There is a fatigue of attention in such work, which causes the same trouble that table drawings do. It is true that the operator does not go back to zero every time, but he does measure from zero every time and pays no attention to the center distance of the hole he has just bored. It will be noted that the small countersunk holes and the pin holes are dimensioned so that they are not likely to be confused with the regularly spaced bushing holes.

Application of the jig borer to work where short lengths of material are indexed independently of a trip-finger or stop pin is shown in Fig. 8. In this case it is desired to register a channel-sectioned piece positively and perforate it as shown. The part is placed in the steel holder and located on the pins inserted in the perforating die shoe. This presents no difficulty and merely illustrates the range of work that can be done on the jig borer.

Any machine that can drill and bore holes accurately in a fixture that is to be used for further accurate drilling of holes in parts of a mechanism, can also drill accurate holes direct in the part of the mechanism. One firm employs six of these borers on precision manufacturing work almost exclusively, using them as drills, boring machines, milling or profiling machines as the operations demand. An example of such work is shown in Fig. 9 where a spindle housing is bored for a long train of gears. These gears run at an exceptionally high speed, and it is expected that the bronze bushings in which the shafts run can be made accurate as to size and concentricity, forced into these holes, and used without further reaming. Registration is taken care of either by a finished spot on the part itself, or by the holder in which it is held. There were 18 of these housings wanted, and if it had been necessary to lay them out in the usual way and "button bore" them on the milling machine a jug would have been justified. With a jig borer it would require 75 or a hundred to justify a fixture, and even then it would be of doubtful economy if the order was not to be repeated. Thus, the new technique of drafting and the expert use of the jig borer also brings into existence an entirely new technique in manufacture.

It is the cost of graphic layout and the necessity of "buttoning" a multiplicity of piece parts in order to obtain the desired accuracy that makes a jig desirable or necessary. Now that the jig borer does the operation as accurately as a fixture could and possibly more so, and as quickly as an ordinary machine, new possibilities are opened up.

As tool engineers, we are beginning to ask ourselves whether the introduction of the jig borer as a machine for making jigs and fixtures may not eventually cause the elimination of jigs and fixtures altogether? Well! Thank goodness a jig borer can't make die punchings.

■

A special bronze for bearings to go with nitrided steel shafts has the following composition: copper 80.2, nickel 5.5, tin 11.5, zinc 2.8, lead a trace. These bearings can be run at high speed with no lubrication whatever.

# EXECUTIVE FORUM

## Misguided Loyalty?

IT WAS still the early side of eight o'clock when Harold Wharton, President of the Channing Metal Works, appeared in the assembly department. He walked slowly from one machine to another until Phillip Clifton, the young Assistant Works Manager, had finished a conversation with the assembly foreman.

"I was going to ask you to come to my office," said Wharton, "but perhaps an informal conversation out here in the shop would be even better. You've been here two years now and are familiar with our way of doing things. How is the work progressing?"

"As well as can be expected," said Clifton. "We have our production troubles of course, but it's all in a day's work."

"To be more explicit, I've been somewhat concerned about Craig lately," said Wharton, referring to the works manager to whom Clifton reported. "His mind doesn't seem to be on his job. I have the impression that he's putting most of the burden on your shoulders. Craig's been getting in late for the past few weeks and lacks his old enthusiasm. What do you think is wrong?"

"You're putting me in a delicate position," said Clifton. "Since I've been with the company Mr. Craig's given me freely of his experience. Much of the training for my present job is due to him. So I owe him a degree of loyalty, especially while acting as his assistant. I feel that I shouldn't be asked to criticize his work or his ability."

"I appreciate your stand," said Wharton, "but I don't believe you regard my question in the proper light. Answering me will not necessarily injure Craig. In fact, it may help him. He may be worried about outside interests of some kind—family troubles or finances. He may hesitate to bring up these troubles himself, but if they could be discovered, there may be some way in which we can help him."

"I'd like to be of service," said Clifton, "but I'd rather have you obtain your information elsewhere. When a man's associated with another in business, as I have been with Craig, he cannot help but obtain an insight into the other's habits and methods. This often leads to mutual confidences. If Craig wishes to acquaint you with his affairs, it should be up to him."

"Your first loyalty should be to the company," said Wharton. "It's our duty to keep the organization as nearly 100 per cent efficient as possible. If Craig, or anyone else, is not on the job, a way must be found to get him back into line. If this can't be done, his period of usefulness with the company may be over. It's my responsibility as president to determine the facts, so that I can act according to my best judgment. Through a misguided sense of loyalty, you're attempting to shield your superior. I can assure you that your stand will not help him in the least, and in addition, is a reflection on your willingness to co-operate for the best interests of the firm."

"We each have our own ideas as to what should be done under certain conditions," said Clifton. "I don't feel I should pass judgment on Craig's actions or divulge information about his private affairs. Furthermore, I don't believe you should insist upon my doing so. I can't conscientiously be a critic and an assistant at the same time. So I must decline to answer your questions."

"Very well," said Wharton. "But perhaps you're passing up an excellent opportunity for yourself. I need men who will put company interests ahead of personal feelings."

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### What Do You Think About This Problem?

**Executives are often critical of those working under them because they feel responsible for the efforts of their assistants. But should the reverse hold true? Should a man feel critical of his superior, and if so, should he voice his opinion? Frequently, one employee is asked to criticize the work of another or to answer questions concerning another's affairs. In some instances, giving such information may benefit the company. Which comes first, loyalty to the firm or loyalty to one's fellow worker?**

# . . . Discussion

## of Executive Problems

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### Convenience or Confusion?

The only reason for the United States and Canada adopting the English system was because of the mother country. The metric system has been adopted as the international standard by the rest of the world. Even in these countries, scientists, mathematicians, and chemists use the metric system except in some commercial work. The metric system was legalized in this country in 1866. In 1891, the values of the U. S. yard and pound were fixed in terms of the international meter and kilogram respectively by the Office of Weights and Measures (now the Bureau of Standards). The metric system is the more logical and easier to use, because all units are decimal subdivisions.

With the English system, the machinist has often to convert eighths, sixteenths, thirty-seconds, and sixty-fourths to thousandths before he can set calipers, or machines by the graduated dials provided. In this conversion there is plenty of chance for error. Anyone who has checked drawing dimensions, such as in machine and tool design, realizes the difficulty of adding and subtracting feet, inches, and fractions of an inch. And in field work, the use of miles, yards, feet, inches, and fractions—to say nothing of rods and furlongs—are confusing especially as they do not bear any common relation or proportion to each other.

To make the change now would involve much expense and take considerable time. It should have been done years ago. To do it years from now will be still more expensive. But the increase in international trade and the larger number of technically trained men entering the industrial field, will no doubt be instrumental in forcing the manufacturers of this country eventually to see the light. —M. E. ROTCHY, *Planning Engineer, Celite Corporation.*

### How Much Incentive?

It is generally agreed that a wage incentive must be large enough to make a man go after it to be effective. The necessary percentages vary with different kinds of work, but usually are somewhere between twenty and fifty per cent. Several well-known industrial engineering firms use thirty-three per cent over the guaranteed hourly rate.

Before deciding on the percentage of time saved that the employee is to be credited with, several things must be considered. First the hourly pay, including the bonus, for class of labor employed must be decided. If this amount is more than twenty per cent over the day work wages, then the percentage of incentive is near that figure. On the other hand, if it is only ten per cent, other factors enter in.

In order that an incentive be present with this low premium, it becomes necessary to reduce the hourly rates. This move is very undesirable as it creates a strong feeling against the new plan. The problem then resolves itself into finding the lowest incentive percentage worthwhile, the least amount of wage reduction necessary, and the highest total wage to be paid.

My answer to this problem would be to use thirty-three per cent incentive, reduce the hourly rates a little, and set them so that the men will receive all the gain in direct labor. This last point will create a favorable view with the workmen and will net the company as much as a fifty-fifty split with a larger time allowance in use. —L. F. SWENSON, *Industrial Engineer, Perkins Machine & Gear Company.*

### Dole or Control?

Whatever may be the moral obligation upon industry, it is at present a practical impossibility for it to make provision for periods of unemployment. The big corporations and manufacturing concerns could possibly manage it, but the smaller ones would find it an impossible burden. At present, it can only be administered on a national scale by the government. The trouble with the operation of the unemployment scheme in this country (England) is that we have not yet found how to keep it on an insurance basis. In essence the scheme is sound and represents a great advance socially. That it has been and can be abused indicates directions in which modifications are still desirable. On the other hand, we have had no experience with unemployment relief controlled by industry directly. It would be most illuminating if some other country could try this method even on a limited scale, so that we could pool our respective experiences. —EDWIN GREEN, *Sheffield, England.*

### The More the Brainier?

Individual responsibility is the best way of getting action, but it is not always the best method of getting a problem solved. In the case under discussion, the die would not operate successfully, but it was not obvious whether this was because of faulty die design, bad material, or incorrect operating conditions. It was therefore a development problem which had to be worked out in the shop.

The works manager wanted production and accordingly instructed his deputy to get busy on the problem. He in turn gathered around him all the brains he thought might possibly be of assistance to him. But, all this assemblage of brains should not relieve chief die designer who is really responsible for the successful operation of the die. The works manager really wanted this man to get all the help he could, and accordingly invested his assistant with the authority to get it. Such a step is logical and should speed up solution of the trouble.

In my own experience, a final assembly production

man found that an order for a large number of duplicate parts would be held up badly because of the non-arrival in the machine shop of a jig from the tool-room. The matter was taken to the production superintendent, who called immediately a stand-up meeting of all concerned: after ten minutes consideration of all sides from design engineers to the assembly foreman, it was decided to forego the jig, and with expensive machining to cut out most of the delay. Here the urgency of the case warranted calling a dozen men off their work for ten minutes. —S. A. KNIGHT, *Irak Petroleum Company, Tuz Khurmatu, Irak.*

## Square Deal or New Deal?

It is quite easy to surround oneself with old colleagues used to one's ways and methods, but is it fair to the concern from whom they are taken? One can of course argue that the old firm should offer sufficient inducements to keep its men, but that isn't always possible, especially in times of depression. To take good men away so one can make a good showing, savors too much of fear and one's own ability.

A reasonable amount of tact seldom fails to overcome that feeling of being overlooked which is inevitable on the advent of a newcomer. If anyone else feels they have been slighted in not securing the position, they should quit or decide to fall in line with the new regime.

—T. H. HARGRAVE.

## Salesmen in the Shop

Certainly the salesman eager for more knowledge concerning the plant's products should not be discouraged, particularly by the works or production manager. Instead, it is the wiser course to co-operate. True, the production phase must be considered, but there is a condition here that well may be recognized—that salesmen be barred from discussing anything other than the immediate interests of the plant; no purely social calls should be permitted that may justifiably irk the works manager.

The object should be to get together in developing, producing, advertising, and selling the products of the plant. That is team-work. If a salesman does break the rule, that is no sound reason for shutting out all ambitious, hard-working, and conscientious men of the sales force. A good feature would be to stage periodical meetings inside or out of the plant; also to plan regular visits, where the various products are thoroughly discussed, the salient elements brought out for the edification of all especially the plant salesmen. The more each learns of the plant's products, the better he will sell.

—FRANK V. FAULHABER.

## Is Interest Important?

In stepping up the inventory by adding interest charges, the balance factor on the other side of the accounts should have been introduced—reserve for obsolete parts or inventory depreciation to be taken from surplus. Careful handling of this would have taken up the shock in several steps instead of in the one increase in inventory dollars.

As managing executives, we say, "That part hasn't been sold for five years. Scrap all but 4 of the 43 pieces and just write them off." Nevertheless we must realize that the good dollars originally invested in the plant have earned no returns for the time spent processing these pieces, and the parts instead of earning money have been depreciating each year. My experience from contact with some fifty to sixty companies leads me to believe that it costs about ten per cent per annum to carry an inventory in any staple line; in the specialties, it runs from fifteen to fifty per cent.

There are really two interest items; for the original investment in the complete plant and the interest on the inventory itself, which should be accumulative after a predetermined period of time. This would satisfy the most exacting accountants. At the same time, the reserve for obsolete parts or inventory depreciation should absorb the interest charges plus a predetermined percentage of the original value of each inactive part. With interest on the investment in the cost of the product as delivered to stores, the sales department would really be a separate business standing on its own feet and would know just how low it could shave selling prices in encountering competition.

—E. E. GAGNON, *Mechanical Superintendent, Raybestos-Manhattan, Inc.*

## Research or Retrenchment?

Research by all means—this I know from experience. During the last depression about ten years ago, the firm I was with brought out a tool, which could be used to great advantage in connection with reconditioning automobiles. The tool sold readily because of the firm's reputation, its special advertising campaign, and the right business conditions. While this was going on, the limited market for the tool was overlooked.

While our chief competitors were more or less hard up during the depression, they developed something entirely new in our regular line, which had formerly been our mainstay. When we woke up, we found ourselves without orders when everyone else's business was picking up. It took us from two to three years to catch up. The loss of business was very serious and our reputation had suffered considerably just because we stopped research and new designs. —J. C. P. BODE.

## How Much Incentive?

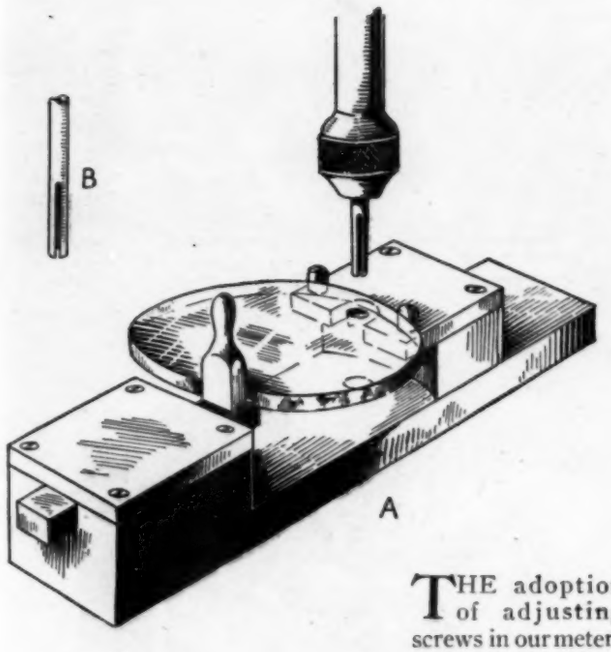
My experience with piecework and bonuses is that they often prove expensive to the firm without giving adequate return. They also have the effect of relieving foremen of their legitimate work of supervision—they feel that the price will keep men busy without attention. It does not always work out, for pieceworkers sometimes have an easier life than dayworkers. Often they have to scamp the job to get anything out of it. Prices are seldom just right.

Incentive does not necessarily mean piecework or bonus. Anything which inspires the best is an incentive. The foreman's incentive is a good job worth looking after. Therefore, make the workman's job so good that he cannot afford to risk it, either by bad work, small output, bad time-keeping, or bad conduct.

—WILLIAM BRYCE,
*Sheffield, England.*

CHARLES H. WILLEY
*Superintendent of Manufacturing, Hoyt Electrical Works*

# Drilling Glass Crystals




THE adoption of adjusting screws in our meters necessitated the drilling of 0.110-in. holes in the crystals, about $\frac{1}{8}$ in. from the edges. From my experience in trying to drill glass on a quantity basis, I found that most of my friends and competitors at the task seemed to regard the art as one to be guarded.

My first attempts were made with a small round file, the end of which was ground to the shape of a two-lipped drill. Using this at a speed of 800 r.p.m. with a cutting mixture of turpentine and fine abrasive, the glass was drilled half-way through, turned over, and the drilling finished from the other side. While we drilled the holes fairly easily, the drill often dulled, causing a lot of breakage. As the drill was undersize to get a sufficent quantity of crystals drilled in a given time, the holes had to be reamed later. For this operation, we used a small round file coated with turpentine and abrasive. Production by this method averaged about fifteen holes per hour.

Then we purchased two diamond drills at a cost of ten dollars each. The drills were run at 1,200 r.p.m., as recommended by the concern that supplied them. The crystals were drilled from both sides, as before, applying water to the drill point by a brush. We obtained excellent results with these drills, getting good clean holes that were up to size. After a lot of practice, the operator was able to drill a hole every two minutes. But we broke the diamond drill on one side, because of heating and cracking under too much pressure. The next drill, a diamond having four cutting edges, was used under water, the crystals being submerged. We obtained the same results as before, but after we had drilled about 400 holes the diamond cracked.

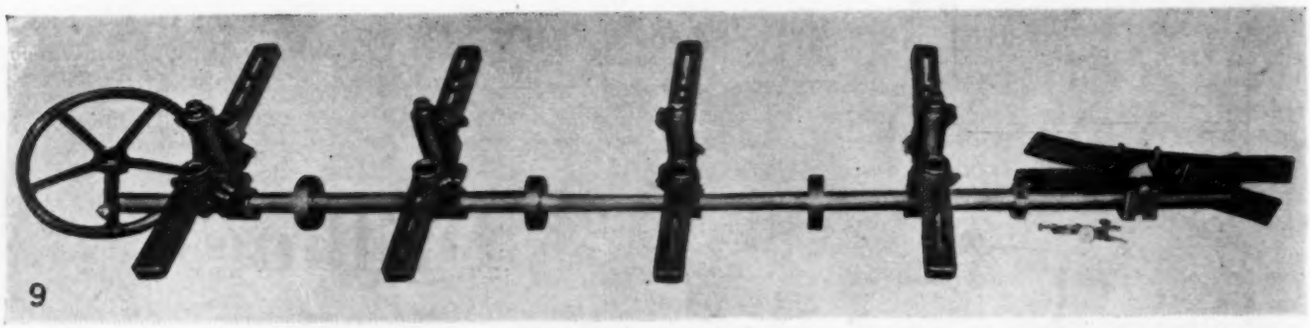
We thought that the sensitive drill we were using permitted the operator to use too much presure, so we bought a regular glass-drilling machine, such as is used on the lenses of eye glasses. After a little practice with this machine, we proceeded to drill the crystals as if we were old hands at the game. Using a few drops of turpentine at the point of the drill, we were able to step up the production to 35 holes per hour, but after a run of 500 or so, we found that the drill was getting dull and required sharpening. Since we knew but little about sharpening diamond drills, we were obliged to ship the drill to the maker and were held up while the drill was being sharpened, so we ordered an extra drill.

We broke the diamond drill after we got it back from being sharpened, so we started a new scheme, that of spotting the crystals on both sides with the remaining drill. The holes were finished with the drill made from the round file and reamed afterward, because we felt that the breakage of the diamond drill occurred just as it was going through the glass. We progressed satisfactorily by this method, getting a production of from 30 to 35 holes per hour.

But I was not satisfied. We needed more crystals to keep up with the production schedule, so I began experimenting with the old stand-by of drilling the holes with copper tubes, using abrasive and turpentine at the cutting ends. The drilling was done from both sides of the crystals, as before, and various grades of abrasive were used. While this method worked all right, it took about three minutes to drill a hole. The holes were slightly bell-mouthed, and we had to be very careful not to chip them at the edges. I kept thinking that we could increase production with the copper-tube drills if we could rig up to have the operator tend two machines. My idea was to drill the first half of the hole in one machine and the second half in the other.

Accordingly, I rigged up two sensitive bench-drills side by side, and made two fixtures to hold the crystals, one of which is shown at *A*. A cam was arranged to raise and lower the spindles alternately, so the abrasive and turpentine could be fed to the drill; the stops were set for half-way drilling. We had great success with this method, for the delicate part of drilling glass seems to be just at the time the drill is breaking through.

Then the idea came to me to slit the copper-tube drills, as shown at *B*, on the theory that the slits would allow the abrasive grains to be carried around with the drills and allow the turpentine to get in and do its work. The little slitted drills fairly ate up the work. The production was increased to 40 holes per hour, with no diamond drills to break at ten dollars a crack. To be sure, we had to ream the holes to size as before, but it took but an hour to ream 300 holes. After each operation, the crystals were dipped in water to wash off the abrasive. Then each crystal was placed between layers of soft paper to prevent scratching.



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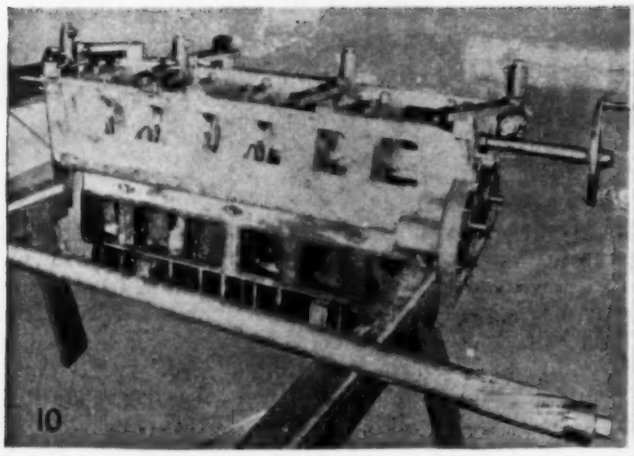

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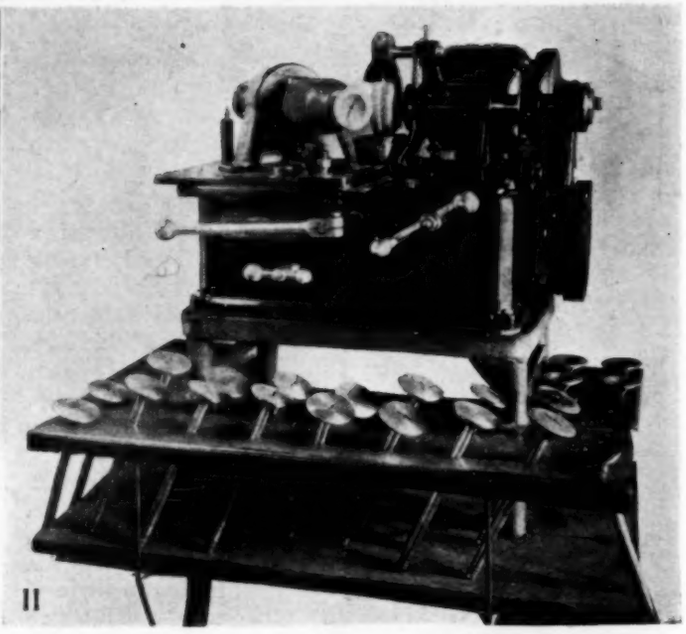
[9] Exceptionally close tolerances may be worked to with the main bearing boring bar used. Bar bearings are of the hinge type, so that when a case bearing has been bored, the bar bearing in front is lipped out, the cutter moved to the next bearing, nd the bar bearing replaced. The feed nut is also hinged to permit quick movement to the opposite end of the thread after a cut, while the bar is slipped back. The feed screw is 64 threads to the inch



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# RAIL MOTOR CAR

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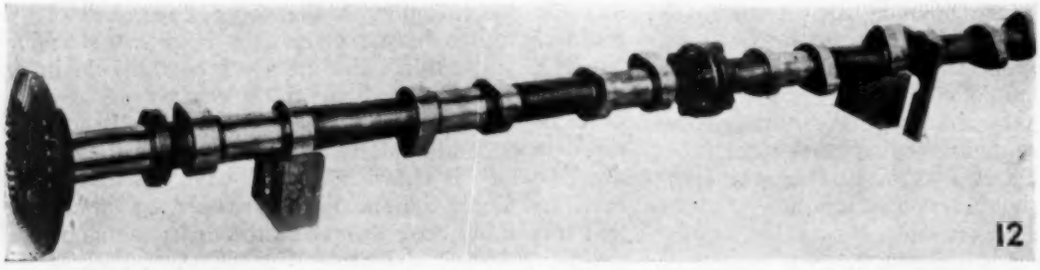

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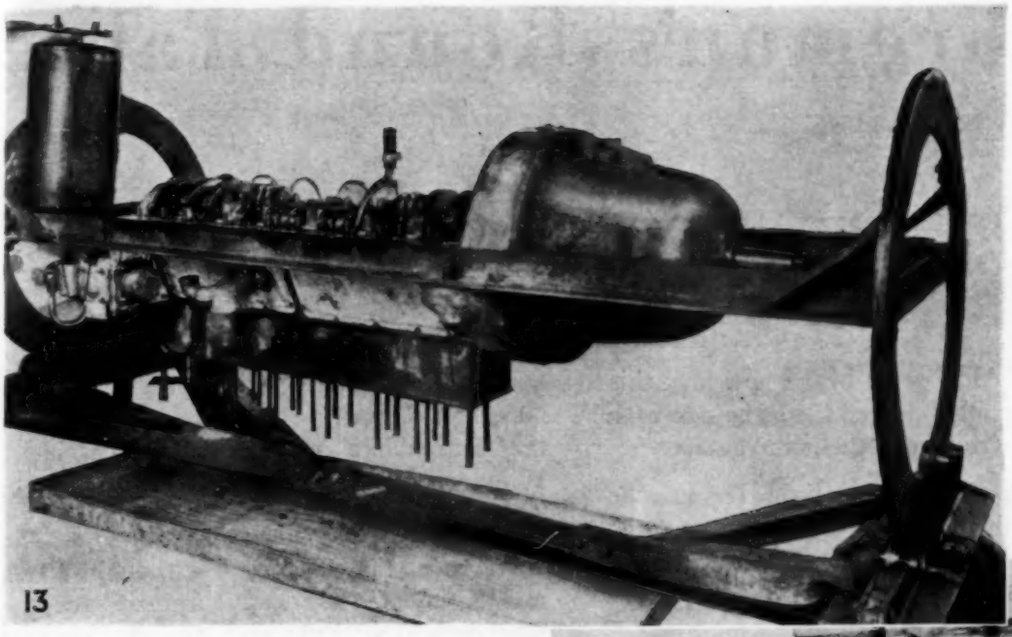
[10] The bar is operated by a handwheel when mounted in a crankcase. It is made concentric with the bearings by means of a dial indicator, and can work to limits of 0.0005 in. Bar bearing assemblies are adjustable horizontally and vertically

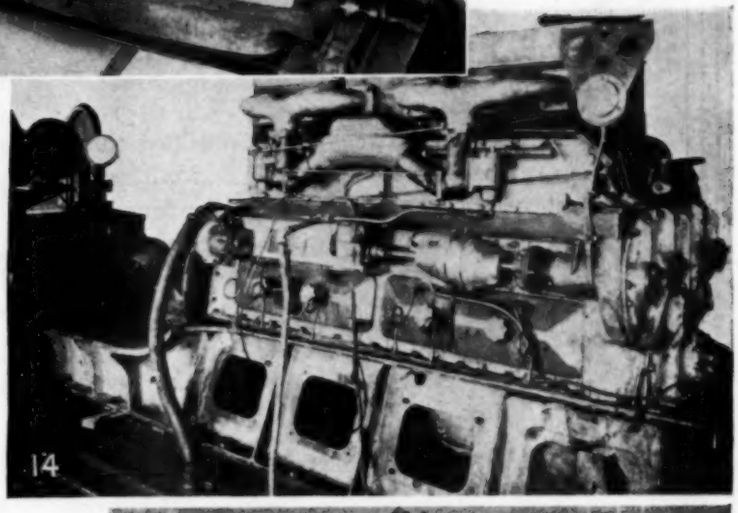
[11] Valves may be refaced to any degree of angle on a valve grinder, and with such accuracy that when put into the reground seats they can be ground in with but a few rubs to a fit which will hold 90 lb. air pressure. The grinder is mounted on a welded stand with holes for holding the valves safely

[12] Cam relations are gaged on a pair of V-blocks on a surface plate. The angle gage is made so that it fits the flat of the cam when held against the side of the V-block. Variations between corresponding cams may thus be checked quickly and positively before assembly

[13] Main and rod bearings are tested for fit and oil lines for tightness by mounting the engine in a portable stand and revolving the crankshaft slowly, while oil is supplied just as in actual service operation. Five gallons of oil in a reservoir (under 90 lb. air pressure regulated down to 60 lb. at which the bypass valve is set) is piped to the engine. Oil is caught in a drip pan beneath the stand



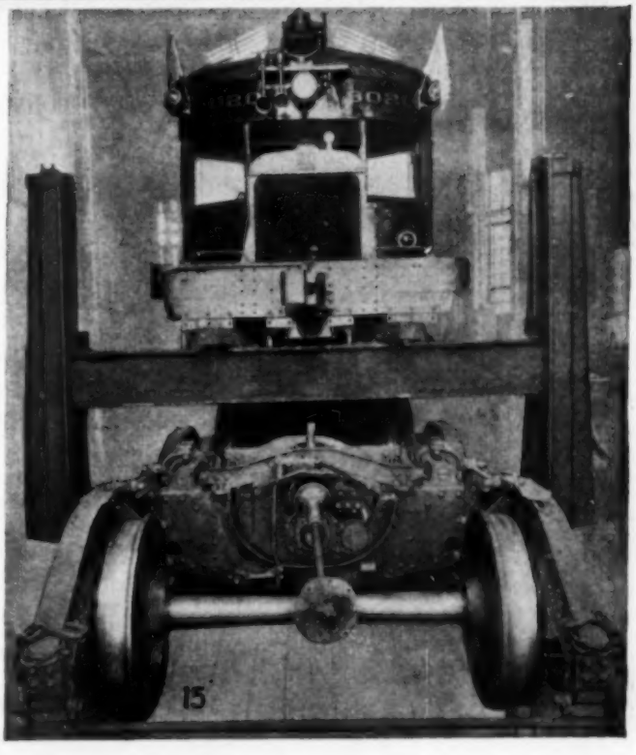
[14] Engines are tested on a hydraulic dynamometer. Mounted on its own bedplate, with dynamometer connections made to conform, the engine is first run in, then given a one-hour test at full load and speed. All features of operation are logged during the entire period, and any difficulties can be rectified before the engine is placed in service



[15] A Whiting screw hoist saves the jacking operation in replacing trucks. Movement is closely controlled, the operation is rapid, and lifting is even at all corners

E. O. WHITFIELD
*Supervisor, Rail Car Maintenance and Inspection, New Haven Railroad*

# REPAIRS NEW HAVEN—II



PROCEDURE adopted at New Haven in order to facilitate the movement of motor cars through the shops is to schedule the work on a complete unit replacement program, that is to say, when a gas-electric car arrives at the shops for general overhaul, the complete engine, generator, and bed plate are removed from the engine room through the car front, and a waiting, completely tested unit replaces it. This system also applies to trucks, compressors, and other equipment, and a similar plan is used at the outside points where cylinder heads, carburetors, magnetos, and other such items are replaced without the necessity of bringing the car to the main shop.

The shopping schedule is, therefore, divided into two parts, replacing and removing of spare units, and repairing and testing of the units replaced. The system has been developed and organized to a point where large economies and gratifying performance are being obtained, with serviceability ranging around 95 per cent.

# The Foreman's Round Table

## THE COST OF QUALITY

"SAY, Al, I got a brand new kick this morning," hailed Ed as he overtook his friend going out the gate.

"Have you? What is it? It must be good from the way you're grinning, and evidently the joke is on the other fellow."

"I'll say it is, and it pins a medal with two palms on me."

"Well, what is the joke? And how come you are so cocky? If nature had not made it impossible, you'd spend half the time patting yourself on the back, and the other half in kicking yourself. Luckily nature had people like you in mind when she created man."

"Is that so? Well I am the only foreman this company ever had that was told his work was done too well. Bite on that."

"You made a mistake, big boy. What the man meant, whoever said it, was that you took too much time doing the work. He was referring to the cost and not the quality. Naturally, you misunderstood him."

"Yeah? Well, Williams may be a little crazy. I think he is in this instance anyway, but he don't generally tell bed-time stories. And I understood him perfectly well when he told me that the quality of the cast-iron starter gears I am making for that automobile concern were entirely too good and the automobile concern was kicking about the price."

"There you are I told you it was the cost."

"No, I got kind of peeved and asked him what was the matter with my time or my set-up, and he said 'absolutely nothing, Ed, except that the automobile company is not finding enough bad ones.' What can anyone make out of such a statement as that? Are the automobile people crazy, or is it Williams?"

"Neither, Ed, Williams was in to see me about those same gears. He thought I was making them. He had forgotten for the moment who had the gear cutters. He said that the automobile people wrote in and said that the gears passed their inspection 100 per cent and that they had not had a single failure in practice. They held the opinion that it was clear that they were paying for a lot of extra time, care, and inspection that they should not. In other words we were producing an extra fine gear and getting a reputation at their expense."

"Can you imagine anyone making a spiel like that? And they used to make a good car at one time."

"They do yet, boy, and they are right in their argument, too. Anyone can make a wonderful piece of work if he can charge the customer for all the work."

"Maybe, but why should anyone kick on quality? I can't see that."

"Because any product that is 100 per cent perfect is costing too much. There should be one or two faulty pieces in every hundred. They know as well as we do that the foundry has scrap, and they know that if we are too finicky in our inspection of castings the foundry charges us more per pound. They also know that we cut a bad gear once in a while, or would if we forced our hobber. Boy, whoever wrote that letter has been through the mill."

"Oh yeah?"

**"Is quality being over emphasized?" "Is the additional cost to the consumer justified?"**

# ▸ ▸ ▸ Discussion of Former Topics

## Age and Its Compensations

Al and Ed sure picked a tough assignment when they decided to determine a "perfectly good" method for establishing machinist wage rates. We have been viewing the same thing from all angles of the compass for many years, and long ago surrendered. No one has yet found a satisfactory solution to this "chestnut," a solution that could be adopted without running into a wilderness of opposition and enemies.

In every profession, men and women draw down pay according to their abilities to produce. Engineers, lawyers, physicians, dentists, scientists, and even politicians, get paid for what they put in, and according to their worth to others. Not so with machinists; not a bit! And the reason is largely their own fault.

How unreasonable to claim that one machinist is equal to the other, and that a particular hourly rate ought to apply to all! Or even that three or four rates, covering various grades or classes, would do the trick. Machinists are as far apart in value and worth as are the most skilled surgeon and the country doctor. Unfortunately, the pay of the machinist is governed by what his employer can get for his services. And as the amount is more or less fixed by competition and the buying public, there is'nt a chance to correct the evil. However, there is sufficient difference between machinists so that a wide variation in their rates is possible. But try and do it!

For example, take a plant which employs 200 men: comb the outfit for those who are far superior to all the others, men who read scientific literature relating to the industry, who have learned to draw and sketch, who keep up to the minute on the latest developments in machine shop practice, who are fast thinkers and workers, always on time, clean cut and honest. You'll find a few, possibly six or seven at the most. Call them into the office, one at a time, and tell them that they'll be raised twenty-five cents an hour over all the others in the plant. Impress on them that it must be kept secret.

The "secret" will be all over the shop before night. And you'll have the other 193 demanding a like rate. Too bad it's so, but every machinist knows that it is.

Skill, efficiency, or seniority cannot play an important part in wage rates so long as men work in large groups, side by side. Invariably, they'll classify themselves as equal to each other, right up to the top with the six or seven, if they have any confidence and self-esteem.

—Raymond H. Dauterich,
*Crescent Engineering Company.*

## In the Driver's Seat

In general, I believe that a foreman who is continually picking at men and correcting their errors, is more of a hindrance than a help in developing a good department.

This habit becomes almost a mania with some foremen and is a result of the assumption that the foreman knows it all, to use the argot of the shop. A foreman, in my estimation, should be a leader and not a driver. A large class of men, especially skilled mechanics, will not stand driving except under conditions where they have no alternative. In such cases they repress their resentment, give only as much as they are compelled to, and watch for an opportunity to make a change.

With apprentices or where unskilled labor is used, direct supervision or training is necessary. Under these conditions, men realize that they have to obey instructions and make good or get out.

When mistakes are made there is usually a reason. In many cases the foreman is to blame. He expected too much and did not give definite instructions, or he started a job and left an unskilled man to overcome unforeseen obstacles.

A leader who knows what he wants and respects the feelings of his men will get good and constant results. Such a man makes certain there is no misunderstanding about the results he expects when he does his part in guiding the whole scheme of his department.

From the man's point of view, his job is usually safer under a nagging or blustering foreman who, as a rule, after he has justified his position, as he thinks, or shown just who is boss, will subside and leave the men alone for a while.

They should, however, look out for the quiet, sure striking type, who lets you go to the end of your rope and then pulls you up short, and often fatally.

—John S. Isdale, *Plant Engineer, International Silver Company.*

## A Friend at Court

Ed's wish to introduce a friend into Williams' shop and Al's comments on it remind me of what happened to my father many years ago.

At the time father worked in the office of a railroad company. Under him was a man whom I shall call Gaynor. He and father were great friends, Gaynor being almost subservient in the haste with which he executed the suggestions of his superior. He always agreed with father, but all the time he was working to get the inside track of his "friend," a fact of which my father had not the least suspicion. Time went on and one day my father was at home sick expecting the doctor. Mr. G. came to the door and asked for father. On being told that he was sick abed, he burst into the room, exclaiming: "Here, you! Get up and come to work! I'm the boss now"! He had got my father's position away from him. After that it was always a slogan in our family to beware of our "friends."

My own experience has been along the same lines. Thrice a supposed friend has worked me out of a job; and that through no lack of efficiency on my part but by carrying tales to the one higher up. So I would agree

with Al whose experience with his "friend," Taylor, leads him to advise Ed to think twice before introducing Joe Black into the shop. Black may be loyal, and then again he may not be. One never can tell.

—EUGENE ARMSTRONG.

## Trade Secrets

Unless men are hired to work along the lines pertaining to the formulas, processes, or ideas which they develop, such formulas, processes, and ideas are the private property of the originators. The company should not appropriate any development of an employee without proper and liberal compensation. Money is one of the strongest moving forces known. The knowledge that ideas will be fairly paid for is an incentive to the mental productivity of employees. Of course, vision, careful judgment, and diplomacy are necessary to secure the best results for all concerned. An idea inadequately compensated for will prove to be a boomerang to the company and a hindrance to the securing of other ideas. At the same time many a man will think that some half-baked dream is worth a fortune. —L. O. BROWN.

## In the Driver's Seat

The sullen man in the shop is one of the foreman's greatest trials, and probably uses up more of the latter's nervous energy than do many mechanical problems.

Personally I have found that these sulkers can never be reassured of your good intentions towards them by any talk or arguments, but a little touch of human nature and personal sympathy will make all the difference. If he has a bad cold, there is nothing lost by asking if he is any better. If he is worried by the illness of his wife or child, the coldest type of man will usually respond to a kindly inquiry each morning as to their welfare. I remember one man who showed resentment when I arrived from a branch plant to supervise. He had considerable influence among the other employees which he used against me. One day I learned he was away from work on account of the death of his mother, and I wrote him a short letter expressing my sympathy. From that time the man's attitude changed towards me, and I had the good will of the shop. I have usually found that men with marked prominence around the ears accompanied by a low forehead, do not respond well to the sympathetic touch, and after a fair trial should certainly not be allowed to remain and use up the nervous energy of the foreman. —ALFRED LAYZELL.

## Who's Who in Industry

Most reasonable people, no matter on which side of the fence they are, will readily admit that the wages paid in industry—and for that matter in any other field of human endeavor—are neither based solely on the relative importance of the work to industry, nor are they based solely on the amount of skill, experience and training required.

A combination of most of the economic factors, such as available supply of labor in a given line, collective bargaining in case of non-independent labor, custom and tariff conditions, immigration conditions, prosperity of the country as a whole and of the specific industry in particular, are some of the items which govern wages.

The enlightened attitude of many executives that only properous workers can furnish good consumers, tends to keep wages at a fair level. On the other hand, artificially and excessively high wages in some industries may simply mean that work which might perhaps be done at a somewhat lower wage level, will be postponed or not be done at all.

Great skill, experience or expertness will only bear corresponding financial returns if someone is in need of these abilities and consequently is willing to bid and pay for them. Frequently such skill may be superseded by some new invention or development in an industry, and there may not be a sufficient demand for the expert in that particular line.

Thus, in many cases, flexibility, or rather adaptability, may be more valuable than expertness in some one line. This is even true of whole industries, as we have seen since the close of the war. —H. J. GUSTAV KOPSCH.

## Check and Double Check

In dealing with cutting tools, where the small shop is concerned, it pays to issue a complete set of required tools to each lathe, planer, or shaper hand, with the distinct understanding that each man is responsible for loss or breakage, replacements to be obtained only on application to the foreman. This, with the addition of a tool locker, or, where space is at a premium, a bench drawer, with lock and key for each man, saves time and dispute.

Special forming tools are best kept apart and issued, by the foreman or assistant foreman, with each blueprint and returned upon completion of the job.

Precision tools, such as micrometers, verniers, etc., should of course be kept in the toolcrib and issued on check. Popular sizes should be duplicated. Extra cost when compared to the saving in time and temper is negligible. This applies to drills, also.

—ROBERT S. ALEXANDER,
*Universal Winding Company.*

## The Tower of Babble

In general there is no reason why men of foreign birth and from different nations should not work side by side without friction. But there are undoubtedly certain native born Americans who do not realize to what depth feelings and prejudices go between certain nationals of the Old World, and who evince a disposition to have a little good natured fun by stirring up animosities between foreign born persons.

Whatever thoughts one may have as to the propriety of this behavior outside of work, it is obvious that such practices should not be tolerated when they interfere with work, as they are then a direct challenge to the management. Any plan that segregates workers on the basis of nationality is wrong. One could just as logically group workers according to their religious or political beliefs. Furthermore segregation of workers by nationality only invites trouble by officially acknowledging and drawing attention to their differences. It presents the very grave danger that, if friction does develop, groups instead of individuals will have to be dealt with.

—GEORGE FIELDING.

THIS ARTICLE concludes *American Machinist's* 1930 Inventory of Metal-Working Equipment. In twenty-four reports previously published, pertinent facts have been disclosed for various industrial divisions. . . . Too many theorists have advanced notions toward the promotion of better business balance. While sometimes meritorious, these notions too often lack a foundation of factual data. If this survey provides a firmer basis for business guidance, the effort made in its compilation will be amply repaid.

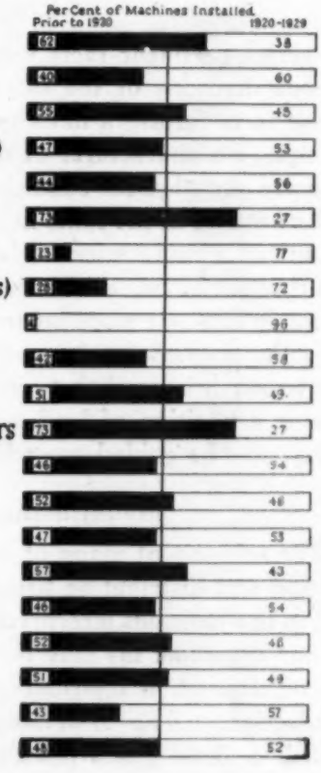
# 48% of Metal-Working Equipment IS AT LEAST 10 YEARS OLD

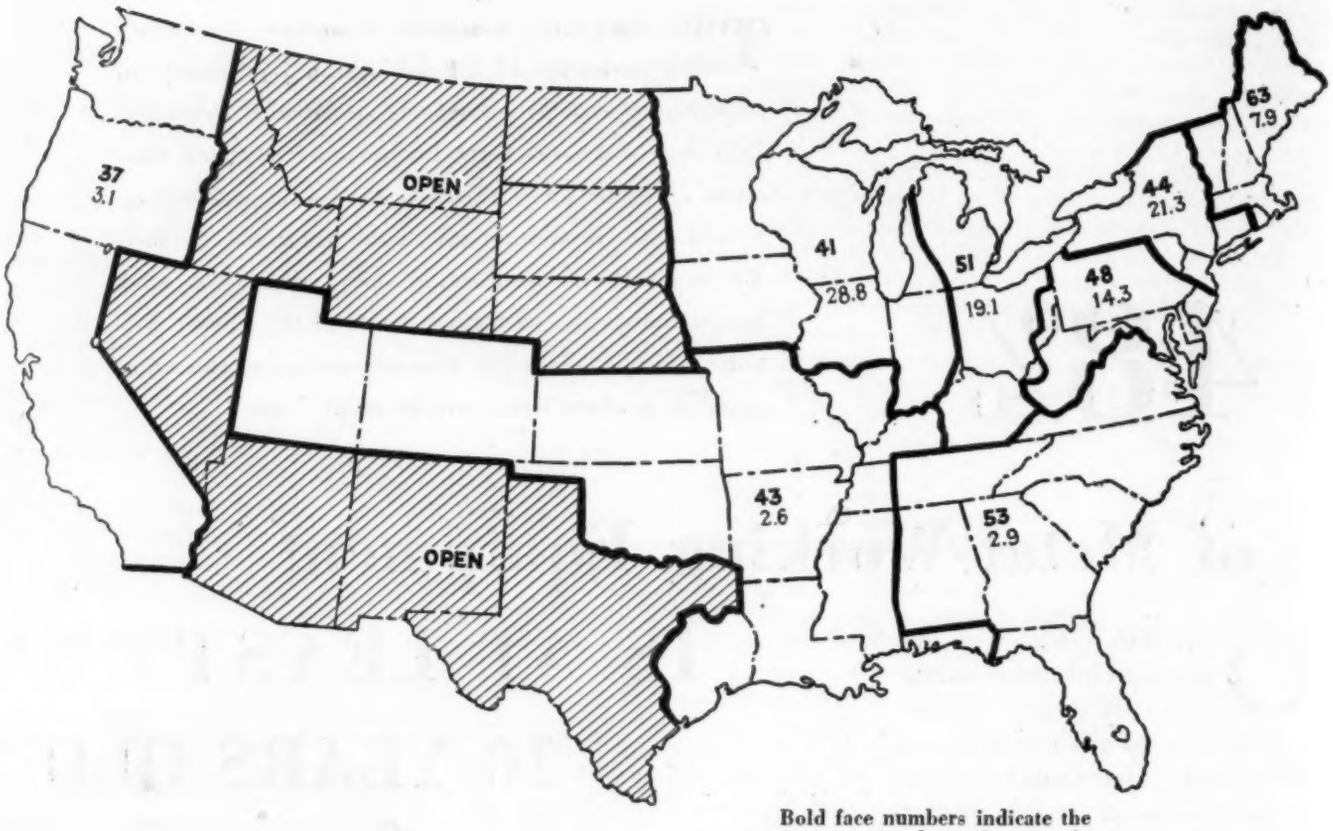
OUR PROGRESS in mechanical invention during the past decade has not been rivaled by any nation in any like period. New tools have been devised, new materials discovered, new methods developed. The ten years preceding were overshadowed by the World War when new design was subordinated to emergency production demands.

Our metal-working plants today are using nearly 1,400,000 machine tools representing an investment of over two billion dollars. Of these, 48 per cent date back to the war and pre-war period and have been outmoded by advanced designs. A certain time lag between the introduction of an improved device and its acceptance in manufacturing processes is inevitable. But it is hard to imagine why this lag should be so unduly extended as to permit the accumulation of this astounding number of antiquated machines.

In the article which introduced the first report of this series, the inventory was described as a yardstick for efficiency. Throughout

**Percentages of Equipment Over and Under Ten Years of Age in Leading Industrial Divisions**


Per Cent of Machines Installed
Prior to 1930
1920-1929
Textile Machinery and Parts 62 38
Hydraulic Mining and Oil Well 40 60
Agricultural Machinery 55 45
Iron and Steel Products (other than machinery) 47 53
Non-Ferrous Metal Products 44 56
Railroad Repair Shops and Car Builders 73 27
Motor Vehicle Bodies and Parts 23 77
Motor Vehicles (trucks, trailers and passenger cars) 28 72
Aircraft and Parts 4 96
Pumps, Fans and Compressors 42 58
Engines and Waterwheels 51 49
Calculating Machines, Cash Registers and Typewriters 73 27
Electrical Equipment 46 54
Foundries 52 48
Paper and Printing 47 53
Wood-Working Machinery 57 43
Food Machinery 46 54
Construction Equipment 52 48
Conveying and Transmission 51 49
Job Shops and Misc. Machinery 43 57
AVERAGE 48 52




**Bold face numbers indicate the percentage of equipment in each region over ten years old. Light face numbers show the portion of the total equipment in place located in each region. States marked "open" are chiefly agricultural**

the series pertinent facts were presented on the various divisions of the metal-working industry. These facts furnish a basis for comparison. For example, a manufacturer of textile machinery can compare the physical condition of his plant with that of others in the same field. He can compare conditions within his industrial division with those of other divisions. Thus he may discover weaknesses in his own manufacturing set-up or determine the reasons for his success. Should he desire to reach beyond the average of his field and assume a position of leadership, his replacement policy may be guided accordingly.

### Maladjustment

The solution of many of our problems of production and distribution lies in exact factual data and in the judicious interpretation thereof. Many of our economic ills may be laid to the door of maladjustment in distribution rather than overproduction. The *American Machinist* survey affords a clearsighted picture of the metal-working market. It shows the total number of machines in place and those in need of replacement. It shows the distribution of these machines by industrial divisions and their relative age with each division.

The regions shown in the accompanying map are combinations of dealer territories as determined by the National Machine Tool Builders' Association. Connecticut, northern New Jersey, and a corner of Pennsylvania are combined with New York. As might be expected, New England, where are located our oldest industrial centers, has the highest proportion of machines over ten years old. The Pacific Coast with only 37 per cent of old equipment tops the list in industrial modernization. The Mid-West has the largest portion of equipment in place and is followed by the New York and Ohio-Michigan regions. These three groups plus Pennsylvania hold 83.5 per cent of the nation's metal-working equipment.

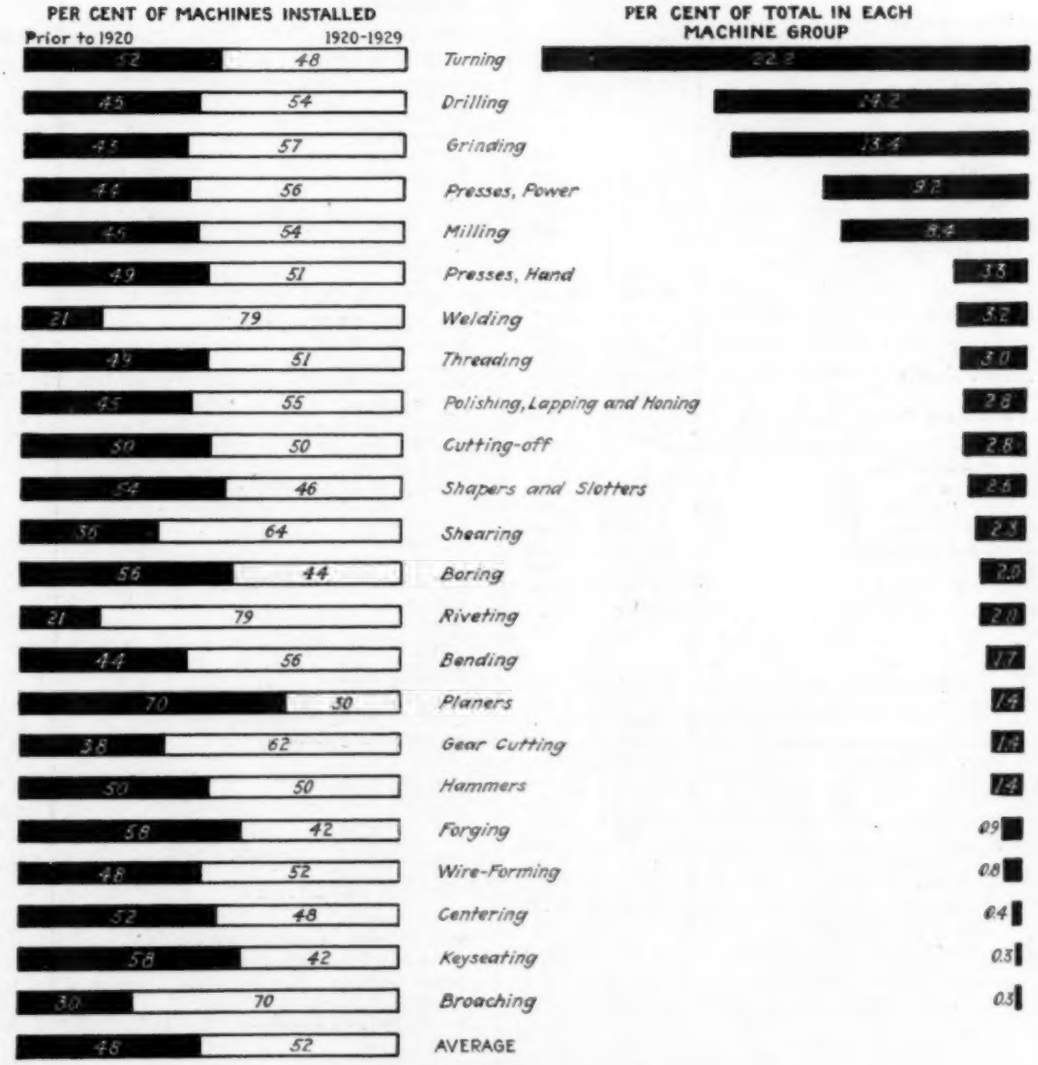
The percentages of old and new equipment by

industrial divisions are shown graphically. Our newest venture, that of aircraft manufacture, has only 4 per cent of its machines over the ten-year mark. Two dissimilar divisions, railroads and office machinery manufacturers, both with 73 per cent, have the largest proportion of old equipment in place. 28 per cent of old equipment for motor vehicles and 23 per cent for bodies and parts put the automotive divisions well toward the fore in modernization.

These figures reflect the extent of the opportunity before the metal-working manufacturer. By making a survey of the needs of his own plant he can plan an intelligent replacement policy. The fulfillment of this program will enable him to reduce his manufacturing costs thus improving his own position and lowering the cost of goods to the consumer. It will stimulate business and thus reduce unemployment. Through the elimination of obsolete units economic waste will be reduced.

Thus the survey will have been presented by regions, by machines and by industrial divisions. Probably many uses can be made of these figures besides those contemplated when the inventory was conceived. Any such use which promotes a clearer guidance to industry will serve to increase the value of *American Machinist's* contribution to the metal-working field.

## Tool Groups According to Relative Age and Numerical Importance


PER CENT OF MACHINES INSTALLED
Prior to 1920
1920-1929
PER CENT OF TOTAL IN EACH MACHINE GROUP
52 48 Turning 22.2
45 54 Drilling 14.2
43 57 Grinding 13.4
44 56 Presses, Power 9.2
46 54 Milling 8.4
49 51 Presses, Hand 3.3
21 79 Welding 3.2
49 51 Threading 3.0
45 55 Polishing, Lapping and Honing 2.8
50 50 Cutting-off 2.8
54 46 Shapers and Slotters 2.6
36 64 Shearing 2.3
56 44 Boring 2.0
21 79 Riveting 2.0
44 56 Bending 1.7
70 30 Planers 1.4
38 62 Gear Cutting 1.4
50 50 Hammers 1.4
58 42 Forging 0.9
48 52 Wire-Forming 0.8
52 48 Centering 0.4
58 42 Keyseating 0.3
30 70 Broaching 0.3
48 52 AVERAGE

## Machines in All Divisions of the Metal-Working Industry

| | Total Number in Plants 1930 | Number Installed Before 1920 |
|---|---|---|
| LATHES | | |
| Engine | 116,467 | 68,538 |
| Hand Turret | 19,638 | 11,224 |
| Power Turret | 22,256 | 8,713 |
| Automatic | 13,543 | 3,203 |
| Chucking | 3,406 | 1,658 |
| Speed and Bench | 28,538 | 16,695 |
| Wheel, R.R. | 2,018 | 1,459 |
| Axle, R.R. | 3,147 | 1,688 |
| Crankshaft | 262 | 73 |
| Toolroom Type | 13,768 | 7,204 |
| Other | 11,843 | 7,420 |
| CHUCKING MACHINES | 6,775 | 1,339 |
| SCREW MACHINES | | |
| Hand | 18,931 | 10,220 |
| Automatic, Single | 27,604 | 12,694 |
| Automatic, Multiple | 19,974 | 8,394 |
| CENTERING MACHINES | 5,139 | 2,664 |
| MILLING MACHINES | | |
| Hand (No Power Feed) | 20,060 | 9,033 |
| Bench | 5,508 | 3,345 |
| Plain | 37,769 | 20,802 |
| Universal | 18,381 | 9,689 |
| Vertical | 14,112 | 4,042 |
| Lincoln Type | 8,084 | 1,674 |
| Continuous | 2,722 | 429 |
| Planer Type | 4,128 | 1,380 |
| Other | 6,214 | 2,955 |
| GEAR CUTTING MACHINES | | |
| Rotary or Milling Type | 7,494 | 3,452 |
| Hobbing | 7,194 | 2,450 |
| Planing or Shaping | 4,186 | 1,401 |
| Other | 1,132 | 389 |
| BORING MACHINES | | |
| Horizontal | 10,743 | 4,939 |
| Vertical Boring Mills | 15,058 | 9,975 |
| Other | 1,108 | 525 |
| JIG BORERS | 1,124 | 348 |
| DRILLING MACHINES | | |
| Radial | 25,740 | 14,707 |
| Upright, One Spindle | 90,356 | 41,077 |
| Upright, More Spindles | 26,568 | 10,911 |
| Upright, Gang | 4,899 | 1,290 |
| Sensitive, One Spindle | 29,956 | 14,224 |
| Sensitive, More Spindles | 10,482 | 5,678 |
| Sensitive, Gang | 849 | 249 |
| Two, Three and Four Way | 1,127 | 216 |
| Other | 7,841 | 2,564 |
| THREADING MACHINES | | |
| Single Spindle Tapping | 13,168 | 5,391 |
| Multiple Spindle Tapping | 3,964 | 2,090 |
| Pipe Threading & Cutting | 5,584 | 3,188 |
| Bolt Threading & Cutting | 10,564 | 6,179 |
| Thread Chasing | 1,620 | 944 |
| Thread Hobbing & Milling | 2,549 | 1,000 |
| Thread Rolling | 2,152 | 1,074 |
| Other | 2,541 | 921 |
| PRESSES | | |
| Punching Machines | 22,271 | 9,843 |
| Punches and Shears | 5,807 | 3,382 |
| Hand, Arbor | 21,403 | 8,348 |
| Hand, Light Punch Press | 5,319 | 2,686 |
| Foot, Light Punch Press | 19,787 | 11,943 |
| Power, Crank Type | 65,407 | 26,560 |
| Power, Toggle Type | 3,293 | 1,113 |
| Power, Double Acting | 2,615 | 1,014 |
| Power, Dieing Type | 2,811 | 960 |
| Power, Trimming Presses | 5,453 | 2,207 |
| Power, Forcing, Arbor | 4,592 | 2,410 |
| Hydraulic, Bending | 3,788 | 2,270 |
| HAMMERS | | |
| Drop | 5,646 | 1,891 |
| Helve | 2,818 | 1,726 |
| Spring | 2,274 | 1,588 |
| Steam | 5,643 | 3,337 |
| Pneumatic | 1,108 | 576 |
| Other | 3,134 | 1,117 |

| | Total Number in Plants 1930 | Number Installed Before 1920 |
|---|---|---|
| PLANERS | | |
| Open Side | 3,892 | 2,603 |
| Double-Housing | 15,509 | 11,013 |
| SHAPERS | | |
| Vertical | 2,933 | 880 |
| Horizontal | 26,433 | 14,791 |
| Slotters | 6,950 | 3,759 |
| KEY SEATING MACHINES | 4,379 | 2,548 |
| BROACHING MACHINES | 4,396 | 1,330 |
| GRINDING MACHINES | | |
| Plain Cylindrical | 24,261 | 12,263 |
| Universal Cylindrical | 9,020 | 3,730 |
| Surface, Reciprocating | 14,021 | 4,578 |
| Surface, Rotating | 8,887 | 3,167 |
| Internal | 9,752 | 2,282 |
| Crankshaft | 1,438 | 288 |
| Cutter | 14,983 | 6,799 |
| Floor | 38,588 | 21,713 |
| Bench | 13,386 | 6,439 |
| Abrasive Disc | 10,624 | 4,766 |
| Abrasive Belt | 3,801 | 1,712 |
| Centerless | 4,273 | 855 |
| Other | 33,865 | 10,955 |
| POLISHING MACHINES | | |
| Abrasive Wheel | 27,429 | 14,310 |
| Abrasive Belt | 4,348 | 733 |
| Automatic | 3,931 | 2,023 |
| LAPPING MACHINES | 3,802 | 898 |
| HONING MACHINES | 543 | 66 |
| CUTTING-OFF MACHINES | | |
| Parting Tool Type | 970 | 568 |
| Power Hack Saw | 21,356 | 10,581 |
| Rotary Cold Saw | 5,588 | 3,088 |
| Bandsaw | 5,928 | 2,291 |
| Other | 5,877 | 3,318 |
| WIRE FORMING MACHINERY | | |
| Spring Coiling | 2,284 | 553 |
| Other | 9,498 | 5,106 |
| WELDING & CUTTING | | |
| Resistance Welding, Butt | 2,607 | 921 |
| Resistance Welding, Spot | 13,424 | 2,557 |
| Resistance Welding, Seam | 507 | 11 |
| Resistance Welding, Other | 887 | 135 |
| Arc Welding | 7,769 | 1,107 |
| Electric Cutting | 7,137 | 1,216 |
| Gas Welding | 6,075 | 1,646 |
| Gas Cutting | 6,795 | 2,127 |
| RIVETING MACHINES | | |
| Pneumatic | 7,181 | 1,402 |
| Hydraulic | 5,136 | 1,050 |
| Power | 9,763 | 2,281 |
| Hydraulic, Wheel Forcing | 4,215 | 2,699 |
| Baling | 1,456 | 225 |
| Other | 6,162 | 3,560 |
| BENDING MACHINES | | |
| Bending Brakes | 9,191 | 2,980 |
| Bending Rolls, Horizontal | 6,083 | 3,236 |
| Bending Rolls, Vertical | 236 | 87 |
| Straightening Rolls | 2,934 | 1,344 |
| Other | 4,880 | 2,543 |
| SHEARS | | |
| Knife | 24,679 | 8,938 |
| Rotary, Slitting | 5,950 | 2,306 |
| NIBBLING MACHINES | 1,477 | 377 |
| FORGING MACHINES | | |
| Bulldozers | 2,154 | 1,216 |
| Hot Forging Machines | 3,622 | 1,998 |
| Cold Headers, Bolt, Nut, etc. | 1,726 | 852 |
| Cold, Swaging | 1,347 | 683 |
| Forging & Flanging Presses | 1,094 | 833 |
| Other Forging Machines | 2,032 | 1,304 |
| Total | 1,390,979 | 664,328 |

*THE ARTICLES by D. W. Ovaitt, which appeared in Vol. 72, pages 903 and 956, describing a system of cylindrical hole tolerances adopted by General Motors, have aroused widespread comment. On page 727, Vol. 73, John Gaillard, Mechanical Engineer of the American Standards Association, discussed this subject in the light of a national standard. A European viewpoint is now presented.*

# TOLERANCES AND TOOLS

## A EUROPEAN VIEWPOINT

DR. N. N. SAWIN
*Research Engineer, Skoda Works, Pilsen, Czechoslovakia*

BECAUSE it is based on the economic use of reamers and bushings, an advantage over other systems has been claimed for the table of cylindrical hole limits described by Mr. Ovaitt. I take the liberty of raising some objections based on research work on this question.

It has been shown by actual experience that one reamer will not produce a hole of exactly the same size in different materials, and for this reason, an identical over-cut cannot be assumed for all materials. Variation is also caused by changes in diameter and working conditions. It is known that a reamer working in bronze on a rigid drill press cuts an undersize hole; hence its over-cut is negative. Similar results, though to a lesser degree, may be observed in brass, aluminum, and in some particularly elastic grades of steel. Only in cast iron and hard steel is the hole a trifle larger than the reamer. It should be borne in mind that these statements refer to vertical spindle drills with floating holders which allow the reamers to follow the hole. A non-floating reamer will cut oversize to a greater degree but may leave unfinished spots in the hole. With other conditions constant, quite different results will be obtained in a lathe or turret lathe; the holes may be oversize considerably more than the stated figure of 0.0007 in. For instance a 1-in. reamer in cast iron on a drill press showed an over-cut of 0.00015 to 0.0004 in.; on a lathe, it showed 0.001 to 0.002 in. oversize. The thickness of the chip plays a very important part.

From the above, it is evident that reamers manufactured in conformity with table II (page 904 of Mr. Ovaitt's article) and used in a vertical machine for Class 6 holes in bronze are not likely to produce work within the desired limits. Most likely the holes will be below the low limit. This may also occur with open-hearth steel. Accordingly, I believe the described reamer tolerances are limited to work on lathes, turret lathes, and other machines with horizontal spindles in cast iron and cast steel only. As to the economic utilization of reamers, almost all other limit systems, such as the A.S.A. (American Standard B 4a-1925) or the German D.I.N. (Deutsche Industrie Normen), offer the same possibility as the General Motors system except that the reamers are transferred from one class to another in the opposite direction. These limit systems have an advantage in that for materials such as bronze and brass, with a negative overcut, reamers of the next coarser class may be used, which cannot be done with the proposed system.

It is true that for the A.S.A. and the D.I.N. tolerances, one bushing cannot be used for all classes of holes, but in the General Motors system, it is doubtful whether in Classes 1 to 4 the bushing fulfills its duty. The difference between the permissible dimensions of the reground reamer and the size of the bushing may exceed considerably the amount of over-cut established by the author. For instance, it may be surmised that for a Class 2 hole with the reamer within the limits of 0.9975 and 0.9980 in., the bushing does not function. Thus the only advantage of the reversed arrangement of hole limits, that is the use of one set of bushings for all classes of holes, becomes of doubtful value.

Now to point out several serious drawbacks to the proposed system:

1. Equal bore limits are established for each class for bores of $\frac{1}{8}$ in. to 3 in. The author had perhaps some real reason for such a simple solution of one of the most important problems of the limit system, namely, the relation between limits and diameter. However, it must be remembered that while a limit of 0.0005 in. may be readily maintained on a good drill press for bores of $\frac{1}{8}$ to 1 in., it may be too close for a 3-in. bore. For the majority of such holes, deviations from true roundness will be sufficient to absorb the total tolerance. If holes are rigorously checked, very few will be found O.K., the balance going into the discard. This point shows that the division into classes and the proposed limits are in no way connected with production practice and are therefore lacking in the elements that constitute a system in the true sense of the word.

2. In most existing systems, the bore tolerances are placed on one side of the nominal hole size with a plus tolerance. This permits simple standardization of many machine elements such as pilots, spindles, shafts, and arbors. They are manufactured to size with a minus tolerance and may be used with a hole in any class; the quality of the fit is thereby increased with the quality of the hole. For instance, a precision way of checking dimensions between holes and their parallelism consists in inserting pins into them and measuring the intervening space by means of precision blocks. These pins are generally made with a slight minus tolerance and are therefore available for holes of all classes giving the closest fit in the highest quality holes and with it the possibility of the most accurate measurement.

The lower the quality of the hole, the greater its plus deviation and the looser the fit of these pins. Requirements as to precision of distance and parallelism will drop in proportion. Accordingly, one set of pins will suffice for holes of all classes. In the proposed system, conditions are reversed; the highest quality hole requires the largest pin which will not pass into the lower quality holes and the number of pins required will be much larger. The same applies to shafts and spindles.

3. Cold rolled or drawn steel is usually made with a minus tolerance. It is often used in machines without finishing for a running fit in lower quality holes. The proposed system materially limits the employment of this stock in standard holes and requires special reamers to obtain a plus deviation.

4. One of the principal objects of the proposed system is the maximum utilization of reamers by using work reamers for class 1, 2, and 3 holes. This means that the actual dimensions of the coarse classes of holes will be near the lower limit of the total tolerance, which will materially limit the standardization of shafts and the establishment of a limit system. For instance, if a loose fit is standardized in one of the high-grade classes, the use of the same shaft in the coarser grades is impossible because it will result in a press fit. Other systems require only a limited number of gages, the combination of which multiples the number of possible fits. In the General Motors system, all fits must be standardized for all classes of holes.

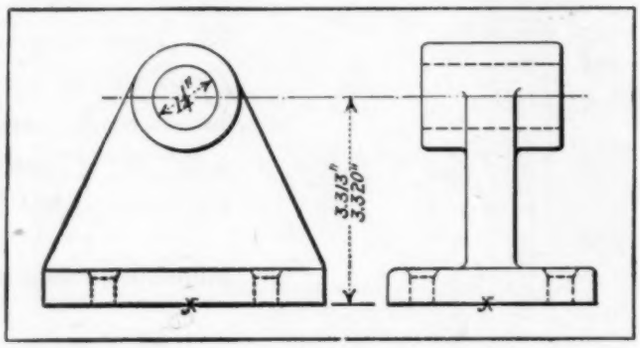
It must be concluded, therefore that the proposed system may be of considerable importance for special work such as jigs and fixtures where economic utilization of reamers is dominant, but it cannot serve as a basis for a general limit system.

## Machining from a Base Line—*Discussion*

T. H. HARGRAVE
*Lancashire, England*

MR. J. T. TOWLSON on page 940, Vol. 72, suggests that it is always best to machine the base of an article as a registering point for succeeding operations. My experience has frequently been the reverse.

For brackets of the type shown, requiring the distance




between the bore and the base to be accurate, we used to shape the base and drill afterwards. Very frequently we had trouble owing to the limits not being held, and we later adopted the practice of drilling first and then—with an arbor through the bore and using that as a datum—machining the base from the hole. This gave us much more satisfactory results. The drilling was done to a layout mark, since owing to the small quantities required, it did not pay to make a jig.

■

## A Planer Completes Itself

RECENTLY the G. A. Gray Company built a large planer with a table too wide to pass between the housings of any machine installed in its shop. Instead of making the table in sections, it was cast in one piece and machined on the planer for which it was designed.

This was accomplished by making the V's on the new planer with the same center distance as those on a 9-ft. shop machine. To take care of the increased width, flat bearings were provided between each V and the table edge. The new machine was assembled to the point of mounting the table, with the exception that its final drive gear was made special to fit the rack on the 9-ft. planer table. The table from the 9-ft. machine was lifted from its bed and type metal bearing pads cast on the under side to fit the flat ways of the new bed. This was considered necessary to prevent deflection under the 100,000-lb. weight of the new table. The old table was then placed on the new bed and the new table casting set up on top of it.

With this arrangement, it was an easy matter to plane both sides of the new table. In accordance with usual practice, the final cut on the table top was taken when mounted on its own ways. Those who are familiar with planing problems will be impressed by accurate machining of the new bed which permitted the interchange of the table from the 9-ft. planer. And those who still feel that no bearing is complete without scraping will be interested to know that there is not a scraper mark on the ways of the new machine.

# IDEAS FROM PRACTICAL MEN

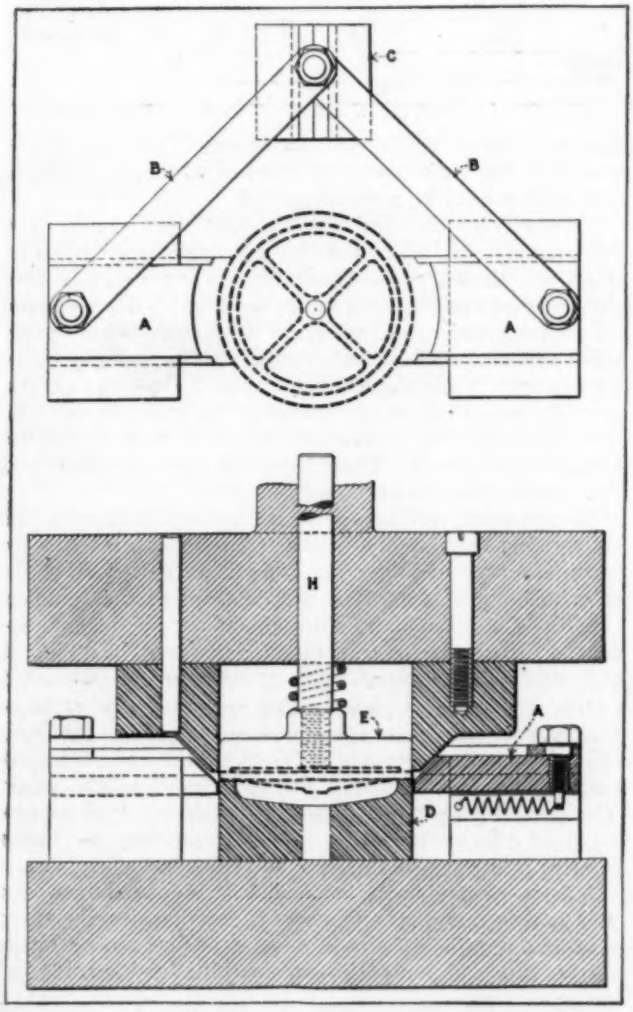
## Equalizing Shaving Tools

C. W. HINMAN
*Chief Tool Designer, Kobzy Tool Company*

WE HAD a large quantity of forged bronze wheels, 3.44 in. in diameter and ¼ in. thick, that had to be shaved around the periphery, and there were no center holes by which they could be located. For doing this work we made the press tools shown in the illustration.

Sliding jaws *A* are mounted on the lower member of the tools, their movement being equalized by the levers *B*. The levers are pivoted together at the rear, the square head of the pivot pin sliding in a T-slot in the block *C*, which is rigidly attached to the die-shoe. Tension springs bring the sliding jaws against the punch *D* when the press ram is up.

In operation, the work is centered by placing it in the angular ends of the sliding jaws. When the die in the upper member descends, the work is forced against the punch *D*. As the die continues to descend, its beveled edge contacts with the angular ends of the sliding jaws, forcing them outward. The work is thus left held and centered on the punch, so that an equal amount is sheared from its periphery as the die completes its downward movement. On the upward stroke of the ram, the work is ejected from the die by the knockout pad *E*, operated by the rod *H*. Ample allowance is made for sharpening the cutting members.




## A Suggested Toolholder for Tungsten-Carbide Toolbits—*Discussion*

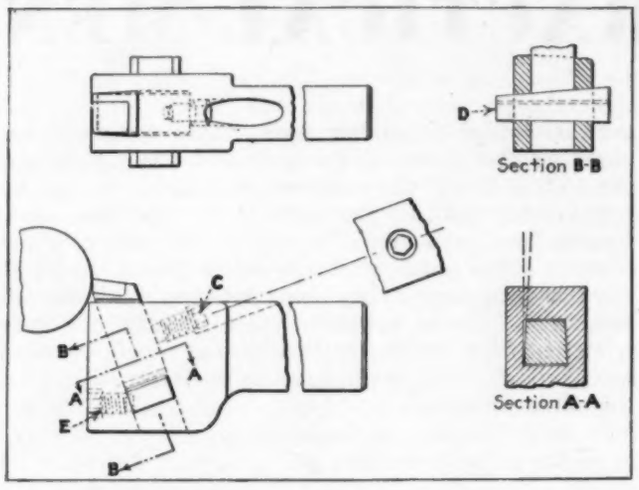
HENRY W. BOEHLEY
*Machine Designer,*
*Mergenthaler Linotype Company*

Under the title given above, on page 521, Vol. 73, of the *American Machinist*, J. T. Towlson describes a toolholder for tungsten-carbide toolbits, which I think can be improved upon. In my opinion, the very thing much desired and of so great importance is sacrificed, for, as Frank W. Curtis states in his article "More Chips From Tungsten-Carbide Tools" (page 608, Vol. 72), rigidity or non-rigidity are nearly always the deciding factors in the success or failure of such tools. Mr. Curtis, of course, refers to toolbits having tips of tungsten-carbide cemented on them; the toolholder here described is for holding toolbits of the same character, while Mr. Towlson proposes to use solid toolbits of tungsten-carbide.

While Mr. Towlson's idea of a foolproof holder is very ingenious, it is my opinion that such a holder will not be rigid enough to make use of tungsten-carbide toolbits to the full possibility of that expensive material economical and to reduce the cost of cutting. I wonder if Mr. Towlson has considered the cost of the kind of toolbit he would have to make in order to use his toolholder. Serrating the back of the toolbit would be an expensive and prohibitive operation, and in making a toolbit of his design, too much tungsten-carbide would be required.

Furthermore, the wedge would not lock tightly enough at assembly, and would permit the toolbit to move downward under pressure of the cut. However slight such downward movement might be, it should not be permitted. The studs holding the adjustable part of the toolholder would permit vibration, if applied in the manner shown.

In the accompanying illustration is shown a toolholder that is very simple in design. The forged-steel body has a hole with tapered sides, as shown in the section *A-A*, the angles being the same in the toolbit. Thus, when the screw *C* is tightened, the toolbit will be locked tightly sidewise, and obviously, backward and forward. The holder also has a rectangular transverse hole for the reception of the wedge *D*. The toolbit is adjusted up or down by tapping the wedge beneath it, which is locked by the screw *E*. Both screws are operated by the same




wrench, and by tightening both screws the toolbit and the wedge are securely locked.

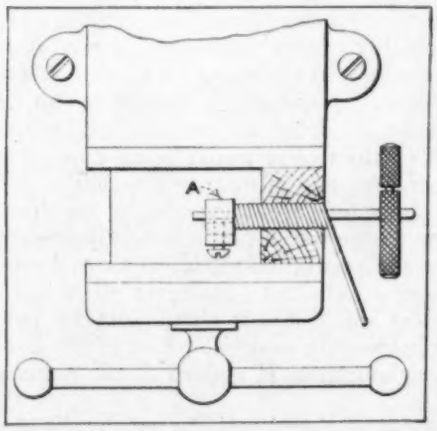
By making the toolholder as large as is possible, considering the machine in which it is to be used, a very strong tool can be had; one that will make the use of tungsten-carbide toolbits economical. The body design can be varied according to the work to be done and the machine in which it is to be used.

■

## Winding Springs in a Vise

R. L. Haselgrove
*Tool Mechanic, Eastman Kodak Company*
*Harrow, England*

Our experimental shop had to make helical-spring driving belts for a cinema apparatus. The material was piano wire, and the external diameter of the springs was not to exceed $\frac{1}{8}$ in. The length was about 8 in. The job could not be done in a lathe, as the mandrel would not be stiff enough to extend such a length from the chuck, or to be run between centers. The job was done by hand in the vise, as shown in the illustration, using a mandrel driven by a wrench.




The small collar *A* is provided with a setscrew by which the end of the wire is clamped to the mandrel. A few turns of the wire are close wound upon the mandrel by hand. Two wooden blocks are placed in the vise, and the starting coils wound upon the mandrel are placed between them. The vise is tightened enough for the coils to make an impression in the faces of the blocks. The mandrel is then revolved by the wrench, the wooden blocks forming half nuts by which the spring is fed along.

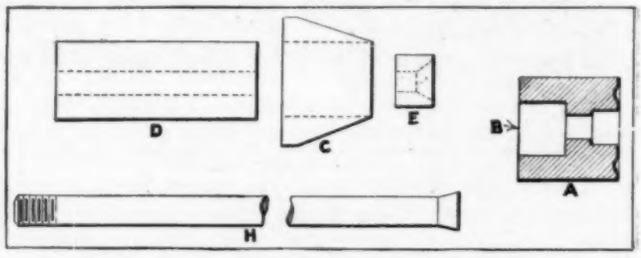
When the wire has been wound far enough to bring the wrench close to the blocks, the collar is loosened and is moved back over the outside of the spring and close to the blocks. The mandrel is then withdrawn so that the end, though still inside the spring, is in such position that tightening the collar screw holds the spring to it. An additional length of spring can now be wound upon the mandrel. These simple operations are repeated until the spring has been wound to the required length.

■

## Internal Chuck

Ralph W. Dicely
*Toolroom Foreman, Mac-It Parts Company*

Having to make a large quantity of parts, such as the one shown at *A*, we experienced considerable trouble in getting the holes at the ends concentric. The part was turned on the outside, the hole *B* bored, and the piece was then cut off from the bar; the work was done in an automatic screw machine. Boring the hole in the other end had to be done in another operation. This caused the trouble as the piece had to be chucked so that the holes at both ends would be concentric.




To overcome the difficulty, we made four chucks, one for each spindle of our Gridley automatic, the details of which are shown in the illustration. First we made sure that the noses on all the spindles ran true. Then we made the tapered bushings *C*, which fit the spindle noses tightly when screwed against the shoulders. The straight bushings *D* were made $\frac{1}{16}$ in. longer than the regular collets, and of the same diameter as that of the collet tubes. The split bushings *E* were then made to fit the rods *H* and the holes *B* in the work. These bushings were hardened and then drawn to a spring temper.

In operation, bushings *D* were inserted in place of the collets, and the noses with the tapered bushings *C* were screwed on the spindles. The rods *H* were inserted in the split bushings *E* and were slipped through the spindles, being held in place by nuts drawn against the finger holders. With the parts entered over the split bushings, it will readily be understood that in the regular feed motion of the machine, the collet tubes will push the straight bushings against the split bushings, forcing the split bushings against the tapered ends of the rods, and expanding the split bushings in the holes *B* of the work. The parts are thus held securely and truly. End adjustment of the work can be made by moving the finger holders by means of the nuts on the rods.

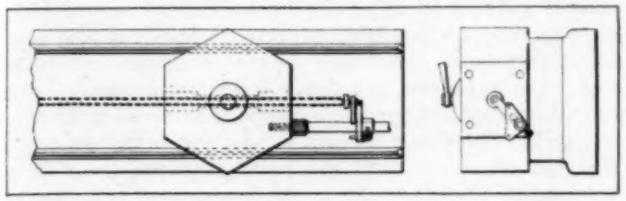
The work can easily be loaded or unloaded from the first position while the machine is running, leaving three positions in which the machining is in progress. Chucks of this type can be used in any machine having collets of the push type.

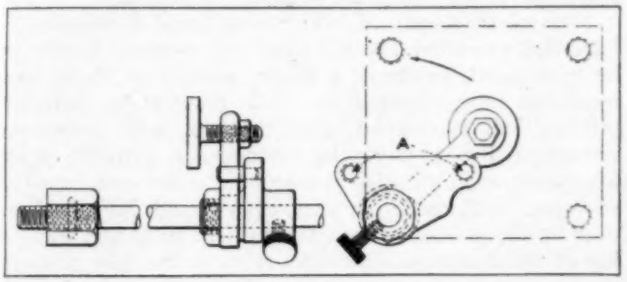
## Adjustable Swing Stop for Turret Lathes

ROBERT W. HAGGAR
*Hamilton, Ontario, Canada*

In cutting off stock in the turret lathe when the pieces to be cut off are longer than the distance between the spindle and the turret, it is necessary to devise some sort of a stop that will permit the work to be gaged for length.

Such a stop is shown assembled in place in Fig. 1, and in detail in Fig. 2. A piece of round cold-rolled stock is






screwed into the lower left-hand hole in one of the faces of the turret, when that face is toward the rear of the machine. A long nut pinned to the threaded end of the rod acts both as a shoulder and as a means for applying a wrench. A bracket carrying a swing stop is fitted to slide on the rod and is held in the desired position by a knurled-head screw. For close adjustment, the stop pin itself can be screwed in or out of the swinging arm, locking it by the nut shown.

The pins *A* limit the position of the swinging arm. When it is against the pin at the right, the stop is in line with the work and is in position for gaging its length. When it is against the pin at the left, the stop pin is out of the way, allowing the piece cut off to be removed. In order to permit the stock to pass through the turret, it is, of course, necessary to drill a hole through from one tool hole to another and through the stud on which the turret revolves.

■

## Counteracting the Index Error of Turrets—*Discussion*

MATTHEW HARRIS

In an article under the title given above, on page 894, Vol. 73, of the *American Machinist*, Gordon Tolley describes a method of counterbalancing errors in turret indexing by setting the cutter in the boring bar vertically instead of horizontally. It seems to me that Mr. Tolley is trying to make the correction at the wrong end. If the turret of his machine did not index correctly, either through wear or an inherent defect in the mechanism, he should have overhauled the machine and corrected the inaccuracy instead of trying to make the position of the cutter cover up the sins of the machine.

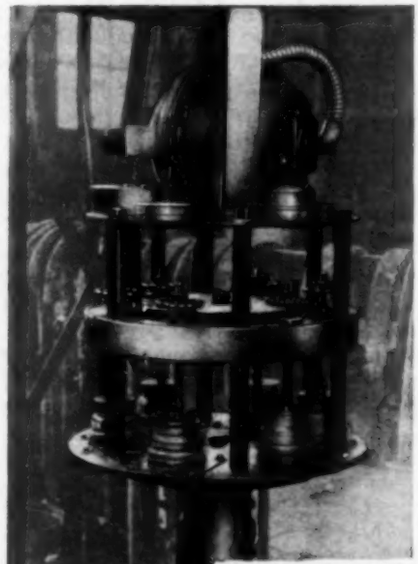
When there is an error in turret indexing, I can readily see that placing the cutter vertically in the boring bar would affect the variation in the size of the holes less than if it were placed horizontally. But I cannot understand why the holes should be out of round when the cutter is horizontal, unless the locking mechanism, the turret slide, or the spindle bearings were badly worn. If such were the case, the lost motion should have been taken up, either by refitting or replacing the worn parts.

■

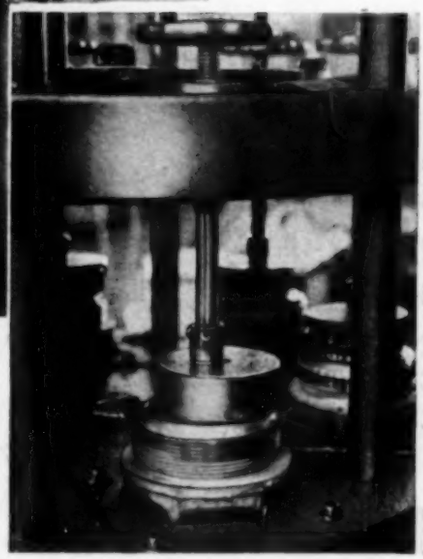
## Device for Lapping Valve Seats

H. P. LEONARD

In Fig. 1 is shown a general view of a home-made device for lapping six blow-off cock valve seats at a time. It is shown in use at the Silvis (Ill.) shops of the Chicago, Rock Island & Pacific Railway Company. Details of the lap are given in the closeup, Fig. 2. A medium grinding compound is used, and the average time required is 15 min.



The hexagon heads of the cast-iron valves are slipped into hexagon cups formed from sheet metal and screwed to a central table. Round bronze disks held in sheet-metal cups with spring holding prongs form the laps and are driven eccentrically through vertical shafts driven from a central gear.



Where they pass through the drive pinions, the shafts have square sections and are free to slide up or down. Each drive shank

is threaded and carries a small handwheel and locknut. By screwing the handwheel down it can be brought into contact with lobes on a horizontal disk, revolving with the central drive gear. In this way contact of the lap with the work can be broken intermittently.

Drive is by a 1-hp. motor through a worm and wheel to a vertical shaft carrying at its lower end a spur pinion which engages the central gear. The motor is mounted on top of the stand, and overhead, in a sheet-metal box, is the motor-controller. Starting and stopping is done by push button control.

■

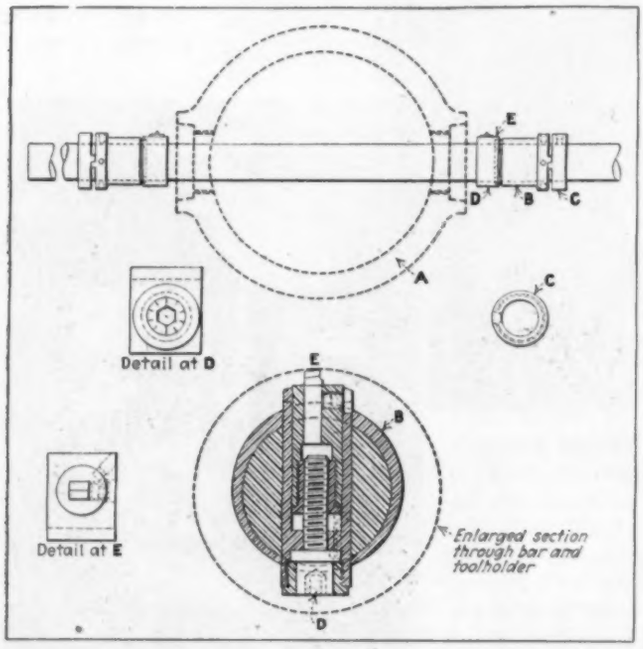
## Threading on a Horizontal Boring Machine

W. L. WATERHOUSE
*Smethwick, England*

The cylinder shown at *A* in the illustration had to have two holes bored and tapped through lugs on opposite sides. The holes were to be bored to 5 in. in diameter and then threaded with 12 threads per in. The only machine available for the job was a large horizontal boring machine equipped for screw cutting. The bar for carrying the threading tools was designed for the job.

Referring to the illustration, the bar is fitted with two toolblocks set at a distance apart to suit the job. The threading tools are adjusted for depth of cut by means of graduated screws, and are locked in the toolblocks by safety setscrews. Withdrawal of the tools from the cut is effected by turning the eccentric sleeves *B*, the eccentric portions of which fit slots in the sides of the toolholders. Projections on the faces of the eccentric sleeves coming in contact with similar projections on the stop collars *C*, limit the rotary motion of the sleeves and serve as dead stops for returning the toolholders to the correct position before adjusting the tools for each successive cut.

As will be seen, the toolblocks are arranged in opposite hands, since it is necessary to reverse the direction of rotation of the spindle when cutting the thread at the left-hand side of the work.




# SEEN AND HEARD

●

### Out of a Pickle

PICKLING, in common with many other processes used in production, is undergoing close scrutiny. The scrutinizers hope that the results it produces can be improved and that these results can be secured more rapidly at lower cost. Certain disadvantages involved also need to be overcome. The latter include hydrogen embrittlement and a failure to remove oxide inclusions. Then, too, considerable labor and expense is involved in keeping the pickle at proper strength. As for other processes that are relatively slow, the tanks required for a large volume of work are large, the investment correspondingly heavy, and the space occupied considerable.

Electrolytic means of overcoming these disadvantages have had extensive study. One such process shortly to be announced, produces a bright surface in about one-tenth the time required for scale removal by ordinary pickling. It is claimed, also, that no oxide inclusions remain on the surface. In consequence, grinding prior to plating is much easier; no oxide is ground into the surface. Such oxide particles, even though later bridged over by the plating, cause pitting of the plate and spreading of the corrosion under it. Also, in the new process, the hydrogen embrittlement is said to be much less, if not entirely negligible. Time is saved, both in pickling and grinding, and finer abrasives can be used, consequently, scratches are finer and are ground out much more easily. Finally, the inexpensive solutions employed are said to last a month where ordinarily they are renewed daily. Electrolytic equipment is needed, of course, but presumably its cost is offset by the savings in tanks and space. The fruits of research benefit all.

### First Aid

MANY OF us when passing through the shop have experienced a tingling sensation in the scalp and a disarrangement of our hair only to discover a crossed belt nearby. This source of static electricity, caused by the friction of the rubbing leather, is put to work by at least one engineer. Occasionally during the afternoon, when his brain becomes fagged through intense concentration, he seeks out a favorite belt with plenty of kick to it. By holding his head near the source of static, he claims he gets a result which beats any scalp massage. It clear up the cobwebs and often wards off an impending headache.

### Expectant Exports

ONE MACHINE maker reports more inquiries for the first two weeks of 1931 than for the last six months of 1930—and what is still more important, an increase in orders for this period. He amplified this statement by saying the orders were small in size but satisfactory numerically. Some of the orders are from Canada and some of the inquiries from England—the latter being a new development. All of which proves that we must not jump at conclusions regarding export possibilities. —*J.*

# Electroplating Tables—II

## CURRENT REQUIRED TO DEPOSIT A GIVEN AMOUNT OF METAL

| AMPERES | DEPOSITS | | PER |
|---|---|---|---|
| | **Copper** | | |
| 1 | 0.000326 | gram | Second |
| 1 | 0.01957 | gram | Minute |
| 1 | 0.1739 | gram | Hour |
| 851.8 | 1 | kilogram | Hour |
| 386.4 | 1 | pound | Hour |
| | **Silver** | | |
| 1 | 4.025 | gram | Hour |
| 112.1 | 1 | pound | Hour |
| | **Gold** | | |
| 1 | 2.4441 | grams | Hour |
| 185.8 | 1 | pound | Hour |
| | **Nickel** | | |
| 1 | 1.099 | gram | Hour |
| 412.8 | 1 | pound | Hour |

## CURRENT CHARACTERISTICS IN PLATING

| | Amperes per Sq.Ft. of Surface | Terminal Voltage |
|---|---|---|
| Copper (acid bath) | 10– 12 | 1–1½ |
| Copper (cyanide bath) | 8– 10 | 3–4 |
| Chromium | 150–175 | 4–6 |
| Brass | 8– 10 | 3–4 |
| Gold | 1– 2 | 2–3 |
| Silver | 1– 2 | ½–1½ |
| Nickel on iron, steel, copper | 4– 6 | 2–3 |
| Nickel on zinc, die castings | 6– 8 | 3–5 |
| Lead | 10– 12 | 1–1½ |
| Platinum | 1– 2 | 5–6 |
| Zinc (acid bath) | 10– 12 | 3–4 |
| Zinc (alkaline bath) | 8– 10 | 2–3 |

## SIZES OF MAIN CONDUCTORS

**To carry a given number of amperes various distances from dynamo to tanks**

| | DISTANCE IN FEET FROM DYNAMO TO TANKS | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Amp. | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 |
| 50 | 1/8 | 1/4 | 1/4 | 1/4 | 1/4 | 5/16 | 5/16 | 5/16 | 5/16 | 3/8 | 3/8 | 3/8 |
| 75 | 1/4 | 5/16 | 1/4 | 5/16 | 5/16 | 3/8 | 3/8 | 3/8 | 7/16 | 7/16 | 7/16 | 7/16 |
| 100 | 1/4 | 5/16 | 5/16 | 3/8 | 3/8 | 3/8 | 7/16 | 7/16 | 1/2 | 1/2 | 1/2 | 9/16 |
| 125 | 1/4 | 5/16 | 3/8 | 3/8 | 7/16 | 7/16 | 1/2 | 1/2 | 9/16 | 9/16 | 9/16 | 5/8 |
| 150 | 5/16 | 3/8 | 3/8 | 7/16 | 7/16 | 1/2 | 1/2 | 9/16 | 9/16 | 5/8 | 5/8 | 11/16 |
| 175 | 5/16 | 3/8 | 7/16 | 1/2 | 1/2 | 9/16 | 9/16 | 5/8 | 5/8 | 11/16 | 11/16 | 11/16 |
| 200 | 3/8 | 3/8 | 7/16 | 1/2 | 9/16 | 9/16 | 5/8 | 5/8 | 11/16 | 11/16 | 3/4 | 3/4 |
| 250 | 3/8 | 7/16 | 1/2 | 9/16 | 5/8 | 5/8 | 11/16 | 3/4 | 3/4 | 13/16 | 13/16 | 7/8 |
| 300 | 7/16 | 1/2 | 9/16 | 5/8 | 11/16 | 11/16 | 3/4 | 13/16 | 13/16 | 7/8 | 7/8 | 15/16 |
| 350 | 1/2 | 9/16 | 5/8 | 11/16 | 3/4 | 3/4 | 13/16 | 7/8 | 7/8 | 15/16 | 1 | 1 |
| 400 | 1/2 | 9/16 | 5/8 | 11/16 | 3/4 | 13/16 | 7/8 | 15/16 | 15/16 | 1 | 2x1/2 | 2x1/2 |
| 450 | 9/16 | 5/8 | 11/16 | 3/4 | 13/16 | 7/8 | 15/16 | 1 | 1 | 2x1/2 | 2x1/2 | 2x1/2 |
| 500 | 9/16 | 5/8 | 3/4 | 13/16 | 7/8 | 15/16 | 1 | 2x1/2 | 2x1/2 | 2x1/2 | 4x5/8 | 4x5/8 |
| 600 | 2x1/4 | 2x1/4 | 2x1/4 | 2x1/2 | 2x1/2 | 2x1/2 | 2x1/2 | 2x1/2 | 4x5/8 | 4x5/8 | 4x5/8 | 4x5/8 |
| 700 | 2x1/4 | 2x1/4 | 2x1/2 | 2x1/2 | 2x1/2 | 2x1/2 | 2x1/2 | 4x5/8 | 4x5/8 | 4x5/8 | 4x5/8 | 4x1/2 |
| 800 | 2x1/4 | 2x1/4 | 2x1/2 | 2x1/2 | 2x1/2 | 2x1/2 | 4x5/8 | 4x5/8 | 4x5/8 | 4x5/8 | 4x1/2 | 4x1/2 |
| 900 | 2x1/4 | 2x1/2 | 2x1/2 | 2x1/2 | 2x1/2 | 4x5/8 | 4x5/8 | 4x5/8 | 4x1/2 | 4x1/2 | 4x1/2 | 4x1/2 |
| 1000 | 2x1/4 | 2x1/2 | 2x1/2 | 2x1/2 | 4x5/8 | 4x5/8 | 4x5/8 | 4x1/2 | 4x1/2 | 4x1/2 | 4x5/8 | 4x5/8 |
| 1100 | 2x1/4 | 2x1/2 | 2x1/2 | 4x5/8 | 4x5/8 | 4x5/8 | 4x1/2 | 4x1/2 | 4x1/2 | 4x5/8 | 4x5/8 | 4x5/8 |
| 1200 | 2x1/2 | 2x1/2 | 2x1/2 | 4x5/8 | 4x5/8 | 4x5/8 | 4x1/2 | 4x1/2 | 4x5/8 | 4x5/8 | 4x5/8 | 4x3/4 |
| 1300 | 2x1/2 | 2x1/2 | 2x1/2 | 4x5/8 | 4x5/8 | 4x1/2 | 4x1/2 | 4x5/8 | 4x5/8 | 4x5/8 | 4x3/4 | 4x3/4 |
| 1400 | 2x1/2 | 2x1/2 | 4x5/8 | 4x5/8 | 4x1/2 | 4x1/2 | 4x1/2 | 4x5/8 | 4x5/8 | 4x3/4 | 4x3/4 | 4x7/8 |
| 1500 | 2x1/2 | 2x1/2 | 4x5/8 | 4x5/8 | 4x1/2 | 4x1/2 | 4x5/8 | 4x5/8 | 4x3/4 | 4x3/4 | 4x7/8 | 4x7/8 |
| 1600 | 2x1/2 | 2x1/2 | 4x5/8 | 4x5/8 | 4x1/2 | 4x1/2 | 4x5/8 | 4x3/4 | 4x3/4 | 4x7/8 | 4x7/8 | 4x 1 |
| 1700 | 2x1/2 | 4x5/8 | 4x5/8 | 4x1/2 | 4x1/2 | 4x5/8 | 4x5/8 | 4x3/4 | 4x3/4 | 4x7/8 | 4x7/8 | 4x 1 |
| 1800 | 2x1/2 | 4x5/8 | 4x5/8 | 4x1/2 | 4x1/2 | 4x5/8 | 4x3/4 | 4x5/8 | 4x5/8 | 4x7/8 | 4x 1 | 4x 1 |
| 1900 | 2x1/2 | 4x5/8 | 4x5/8 | 4x1/2 | 4x5/8 | 4x5/8 | 4x3/4 | 4x3/4 | 4x7/8 | 4x 1 | 4x 1 | .... |
| 2000 | 2x1/2 | 4x5/8 | 4x1/2 | 4x1/2 | 4x5/8 | 4x5/8 | 4x3/4 | 4x7/8 | 4x7/8 | 4x 1 | .... | .... |
| 2100 | 2x1/2 | 4x5/8 | 4x1/2 | 4x1/2 | 4x5/8 | 4x3/4 | 4x3/4 | 4x5/8 | 4x 1 | 4x 1 | .... | .... |
| 2200 | 2x1/2 | 4x5/8 | 4x1/2 | 4x5/8 | 4x5/8 | 4x3/4 | 4x7/8 | 4x7/8 | 4x 1 | .... | .... | .... |
| 2300 | 4x5/8 | 4x5/8 | 4x1/2 | 4x3/4 | 4x3/4 | 4x3/4 | 4x7/8 | 4x 1 | 4x 1 | .... | .... | .... |
| 2400 | 4x5/8 | 4x5/8 | 4x1/2 | 4x5/8 | 4x3/4 | 4x7/8 | 4x7/8 | 4x 1 | .... | .... | .... | .... |
| .... | 4x5/8 | 4x1/2 | 4x1/2 | 4x5/8 | 4x3/4 | 4x7/8 | 4x 1 | 4x 1 | .... | .... | .... | .... |

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More formulas and instructions for plating and coloring metals are included in Crown Catalog No. 30


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VOL. 74 NO. 7

## *The Replacement Opportunity*

OPPORTUNITIES are revealed in every line of the summary of the 1930 Survey of Equipment published in this number of *American Machinist*. Every metal-working plant manager has the opportunity to check his plant with the practice of his industry, and of other industries. If he is wise, and has the wherewithal, he can steal a march on his competitors by bringing his equipment a step or two ahead of theirs through replacing that part of it which is out-of-date.

Where industry competes with industry for the customer's dollar there is opportunity to compare equipment condition, and by replacing the obsolete, to offer a better product at lower cost with correspondingly improved markets.

The machinery builder; the builder of other production equipment; the maker of small tools, chucks, and the like; all will find in this summary a picture of the market that is the best yet developed. If each of these individuals will supplement this general picture by a study of his own particular product conducted along similar lines, he will have in the combination a means of sales control that will leave little to be desired, an opportunity of prime importance.

As Dr. Klein said in his radio broadcast which was reproduced in last week's number, "There is surely no justification for retaining in American factories machinery which is undeniably antiquated. That can mean nothing but hampering, cluttering waste. It impedes the flow of progress." The opportunities are clear. Let us make the most of them.

## *History Repeats in Cutting Tools*

TO THOSE who remember when Mushet steel was a novelty and when the Taylor-White tools gave them a thrill by cutting with the tool point red hot, the wide interest in tungsten carbide tools is not such a shock as might be supposed. High speed steels and Stellite paved the way. And just as the earlier cutting tools forced them away from the light weight machines that used to claim admiration for their easy handling, so the newer cutting tools are influencing the design of still newer machines.

Beginning with the simpler tools used in the lathe, shops now have milling and other machines designed especially to handle the higher cutting speeds now made possible. Even though milling cutters require a T-C tip on each tooth, making the total cost of a cutter much higher than formerly, the results evidently warrant the cost not only for the cutter but for designing the machine to drive it to its maximum economical speed.

Perhaps one of the best features in the use of these new cutting tools is the education of users to the fact that first cost is far less important than the net cost of results obtained. Men who said that no cutting tool could be worth the price originally asked for T-C are now specifying it for widely diversified uses.

## *Investing in Integrity*

FOR those to whom the suggestion of deferred payments on production equipment conjures up visions of catastrophe there is a way out. It is a way that permits them to act as hardboiled business men and as human beings with a little sporting blood, at one and the same time.

One machine tool builder has used this way, and it has never played him false. His method of applying it has been to follow the fortunes of an ambitious foreman or other minor executive who has started out on his own to build a business. In selling machines to this man he has accepted notes, but instead of asking the company to stand back of them he and two or three other company executives indorsed the notes as a personal matter.

The company cannot lose, and up to date the officials who have indorsed these notes have not lost a cent. These cases are not very numerous, perhaps, but occasionally one appears, and with it a chance to build a good customer from a little fellow who started with not much more than his skill, integrity, and nerve.

Such investments in integrity account for but a small proportion of the business of this machine tool builder, but what a large figure they represent in the satisfaction he gets out of his daily work!

# SHOP EQUIPMENT NEWS

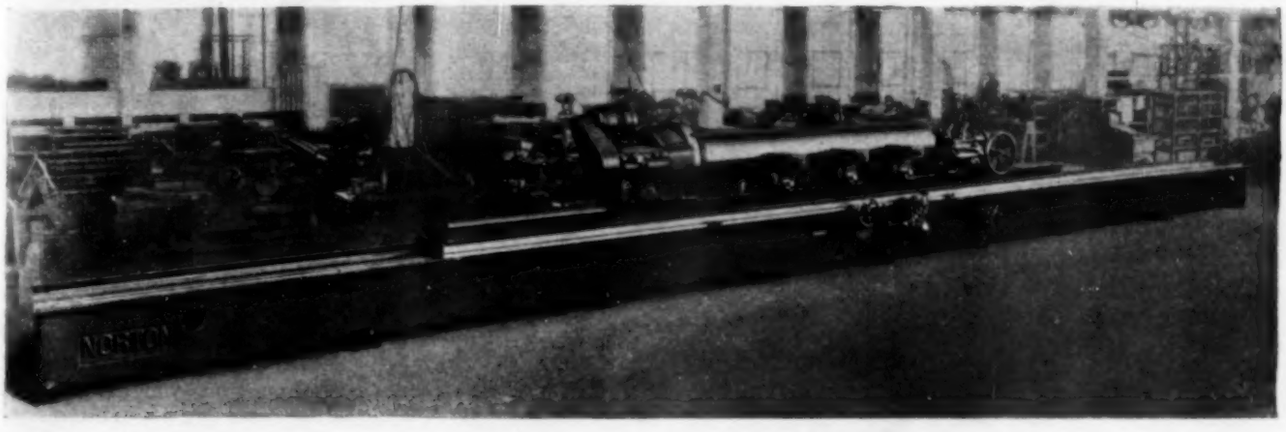
## Norton 36x288-In. Roll Grinder

RAMS and columns for hydraulic presses manufactured at the Eddystone plant of the Southwark Foundry & Machine Company will be ground on the 36x288-in. roll grinder recently built by the Norton company, Worcester, Mass. The limit of allowable weight is 40,000 lb., and the machine employs a traversing table. It will grind to a mirror finish and to within limits of accuracy of 0.0005 in. for concentricity and straightness. In test, it has removed stock from a large cast-iron column at the rate of 6 cu.in. per min. It will permit finish grinding direct from rough turning, effecting a saving over the former method of finish turning and polishing, while obtaining a higher degree of accuracy and better finish.

The machine is built along the same principles of design as all Norton cylindrical grinding machines. The work is driven by a headstock, which in this case has a 10-in. live spindle with a ball bearing assembly of 16⅛ in. in diameter. The headstock is equipped with a chuck, and at the outer end the work is supported by a footstock provided with a regular center. These alloy steel centers are 4½ in. in diameter and 24 in. long. Both the headstock and the footstock are adjustable along a massive work table, which when finished weighs 16,448 lb., and is cast in a single piece.

The wheel slide is supported by large ways, one flat and one V-shaped, provided with "one shot" lubrication. Movement of the slide is obtained by means of a large feed screw and half nut lapped together to act as an immense micrometer. This mechanism can be adjusted in position to within 0.000125 in. Provision is also made for moving the wheel slide in and out rapidly by power.

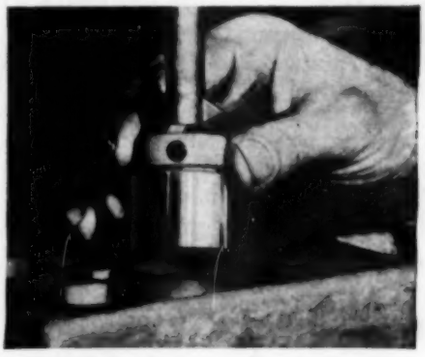
The base of this roll grinder is 57 ft. long and is made in three sections weighing 36,755 lb. The machine has a patented interlocking device on the table drive mechanism, and twelve speeds are provided for the work table. The motors required are of 30 hp. for the wheel and table traverse and 20 hp. for the headstock.




**With a length of 57 ft., this immense Norton Roll Grinder is capable of taking rams and columns for hydraulic presses up to 36 in. in diameter by 288 in. long**

## Pratt & Whitney Stub Gages

Small clearance is required in the use of the stub gages announced by the Pratt & Whitney Company, Hartford, Conn. They can be used in precision boring operations where the clearance between the tool and the hole is small. In most precision boring machines the vertical travel of the tool is obtained by a quill, while the head itself remains clamped in one position. This is a desirable practice, because a movement of the head itself to provide gaging clearance below the tool might introduce errors that would be objectionable if the tolerances are very close. With the stub gage marketed, however, this difficulty is overcome as the ordinary quill travels provide sufficient clearance for its use.



**Illustrating the small clearance required in the use of the Pratt & Whitney Stub Gage on precision boring operations**

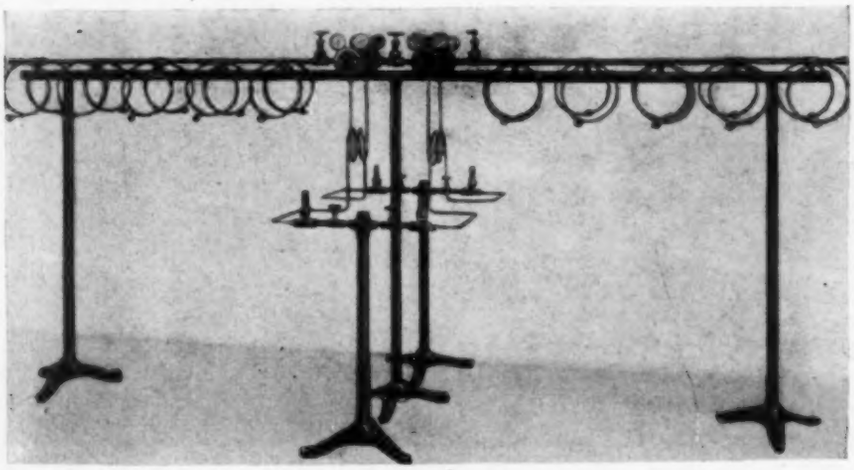
This gage is made with the usual cylindrical gaging surface, but a short knurled fingergrip is substituted for the handle. Larger sizes are hollow

Set of 17 Pratt & Whitney Stub Gages

for lightness, and a hole through the fingergrip permits the insertion of a pin when necessary. The tool is made of alloy tool steel, heat-treated, and the gaging surface is lapped to size. Gages are available either singly or as a set of 17 sizes in a wooden case. Sizes are $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$, $\frac{5}{16}$, $\frac{3}{8}$, $\frac{7}{16}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$, 1, $1\frac{1}{8}$, $1\frac{1}{4}$, $1\frac{3}{8}$, $1\frac{1}{2}$, $1\frac{3}{4}$, and 2 in.

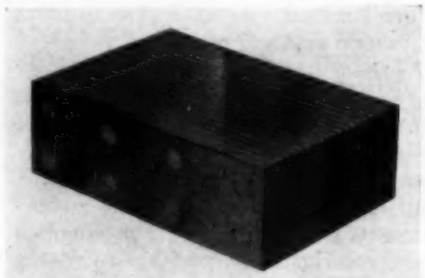
## Milburn 20-Tank Manifold

Intended as a central source of supply for cutting and welding torches, a 20-tank manifold has been developed by The Alexander Milburn Company, 1416-28 West Baltimore St., Baltimore, Md. These manifolds are constructed of bronze tubing and employ Milburn standard gas regulators and copper coils, mounted on a tripod. They eliminate the necessity of transporting cylinders about the plant, and it is possible to secure uniform pressure for all operations. A feature is that, if desired, each tank or each side of the manifold may be operated independently through separate shut-off valves, thus allowing the torches to continue in operation while the tanks are being connected or disconnected.



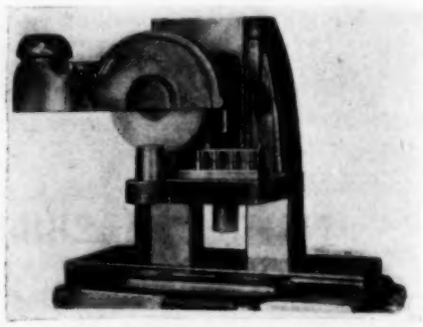
## Congress Ready-Made Magnetic Blocks

Magnetic blocks for supporting pieces to be ground are manufactured on a standardized, interchangeable basis by the Congress Tool & Die Works, 430 South Green St., Chicago, Ill. They are built up of a number of laminations of special alloy "electric" steel, separated by non-magnetic layers or segments of uniform thickness. All sections are riveted together by non-magnetic rivets. The blocks measure $3\frac{3}{4}$ x $2\frac{1}{2}$ x $1\frac{1}{4}$ in., and all faces are ground true. The magnetic circuit has been designed to cut down the hysteresis or iron losses and leakage flux between laminations. Because of the design, these blocks may be placed much closer to the edge of the standard commercial electric chuck or table because the flux density is high.



"Bulldog" Magnetic Block, showing silicon steel laminations, non-magnetic segments, and rivets

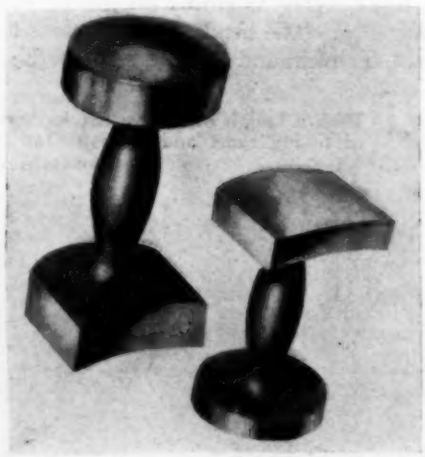
These "Bulldog" blocks may be used two, three, or more at a time and a quick set-up can be made. Sheet steel 0.005 in. thick can be held so that one or two ten-thousandths can be ground off without difficulty. Two or three blocks may also be mounted one on top of the other in series or placed parallel to each other. The blocks are sold in pairs from stock.



Typical set-up of "Bulldog" blocks, showing two blocks holding down a punch holder and punches in a set-up made in less than 2 min.

## Whitney Hand Dolly for Sheet Metal

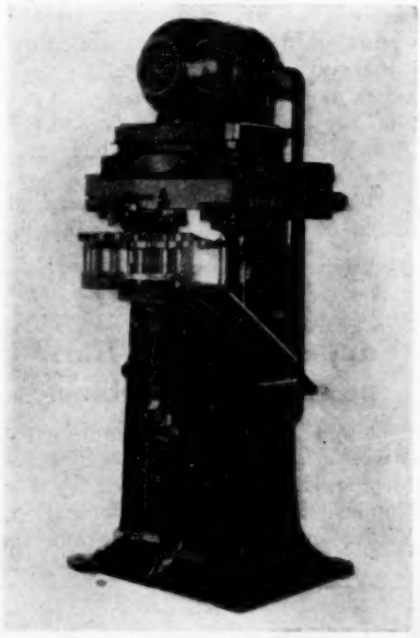
Hand dollies in two sizes have been placed on the market by the Whitney Metal Tool, Rockford, Ill., for use in sheet-metal work. This type of dolly can be used in seven different positions and is so designed that it will not roll when laid lengthwise on the bench. The large one is intended for the shop and weighs $7\frac{1}{2}$ lb., whereas the small one fits in a toolbox



and is used on outside work. It weighs 3 lb. Both are drop forged, and all machined surfaces are hardened.

## Martin No. 12 Hydraulic Marking Machine with Disk Feed

For marking valves, the Martin Machine Company, Inc., Turners Falls, Mass., has developed a disk-feed valve marking machine from one of its standard No. 12 hydraulic marking machines. The disk is revolved by the action of the table cylinder that operates the machine. Valves are inserted in the front by an operator and twirled out on the right-hand side by a cam. Production on this machine is approximately 50 valves per min. This is as fast as an operator can pick them up and insert them, although the machine will run as high as 60 to 63 strokes per min. It can also be adjusted down to any speed required. One of the features is that it will mark uniformly even though the valves vary in thickness. The disk rests on a ball-bearing thrust collar and has a hardened anvil that comes under the point where the marking is done.



**Martin No. 12 Hydraulic Marking Machine with Disk Feed arranged for marking valves**

## Preeco Special-Atmosphere Electric Furnaces

Prevention of oxidation and the formation of scale by the use of a gas, a mixture of gases, or a vapor to exclude air is the principle employed for the special-atmosphere electric furnaces developed by the Process Engineering & Equipment Corporation, Attleboro, Mass. Air is kept from the material while it is being both heat-treated and cooled, and is removed from the furnace in a bright, clean, and dry condition ready for succeeding operations or finishing. This bright annealing of ferrous and non-ferrous metals and alloys effects economies through the elimination of dipping, pickling, cleaning, and drying operations.

The design of the furnace is usually special and is based on a consideration of three factors: First the application of the special atmosphere best suited to produce the desired results; second, control of the atmosphere to insure the maximum economy of operations; and third, efficient design to meet the required specifications. The furnace is built in such types as box, conveyor, continuous hearth, pot, and continuous strip and wire. Variations in these types and varying sizes are specified to meet particular requirements.

The "Preeco" box-type special atmosphere electric furnace shown in Fig. 1, is of conventional design with relation to the frame, doors, heating unit, hearth, refractory, insulation, and automatic temperature control regulation. In operation, the material is moved from the loading platform through the front door into the fur-

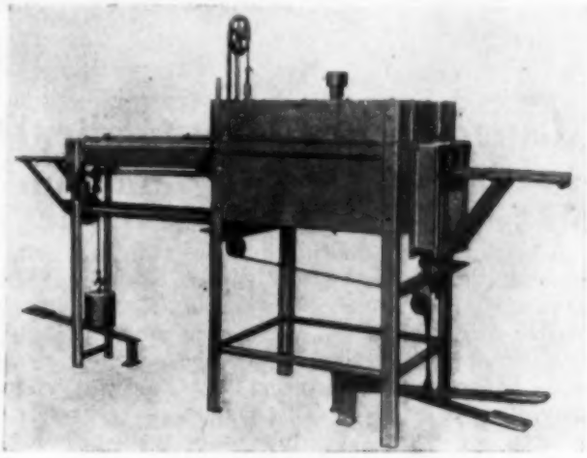


**Fig. 1—Preeco Box-Type, Special-Atmosphere Electric Furnace, available in sizes from a few kw. to models for production on a tonnage basis**

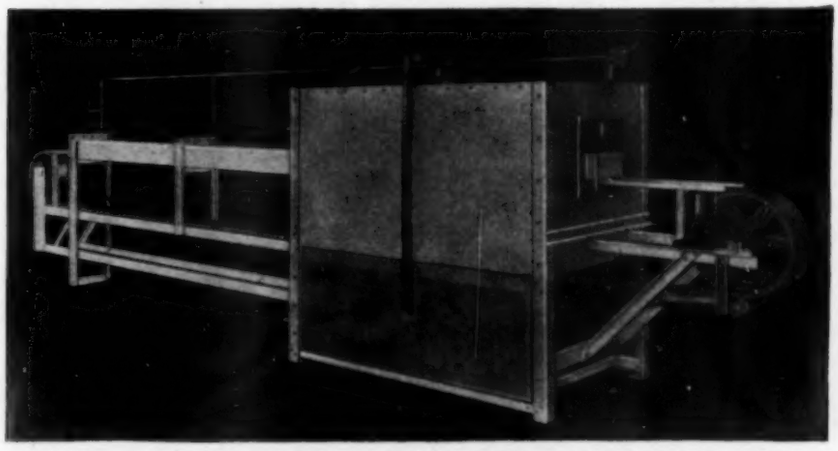


**Fig. 2—Preeco Conveyor-Type Special-Atmosphere Electric Furnace for bright annealing, bright silver soldering, bright brazing, and vitreous enameling on a production basis**

nace and heated in accordance with standard practice. It is then moved out the back of the heating chamber, and through an intermediate door to a cooling chamber. When the temperature of the material is below the oxidation point, it is moved through the rear door to an annealing platform. The furnace is built in all sizes and types from small units of a few kilowatts capacity for bright annealing precious metals, to units designed for bright annealing various ferrous and non-ferrous stampings, blanks, tubing and wire on a tonnage basis.

The conveyor furnace, illustrated in Fig. 1, is designed to secure continuous operation and automatic control of heat-treating time, as well as the automatic control of temperature. Material is moved from a loading platform into the heating chamber, either continuously or intermittently, at a rate to secure the required heat-treating time. In the bright annealing of material for blanking, stamping, drawing and rolling operations, this type of furnace reduces the number of handlings from 50 per cent to as much as 90 per cent. This type of furnace can also be employed for vitreous enameling.

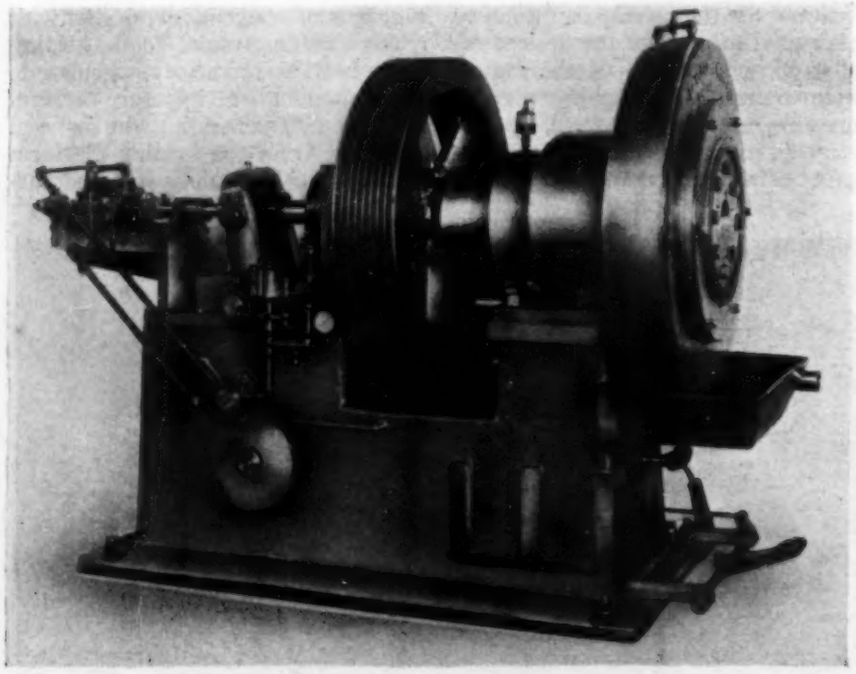
## Langelier Semi-Automatic, Die-Opening Swaging Machine

A machine for automatically compressing the pocket end of copper terminals onto the ends of insulated flexible wire cables by the rotary swaging process has been developed by the Langelier Manufacturing Company, Providence, R. I. This method of attaching presses the tubular or pocket end of the terminal and the strands of wire into a solid mass, and makes for a strong connection. It can be done at much faster rates than soldering. Dies and spring collets for swaging eleven sizes of terminals are provided, that is for No. 1-GR lead to No. 12-GR lead.

Two types of terminals can be swaged onto the cable, one being a plain cylindrical copper tube, the blade end being formed after the swaging operation is completed. In the other type, the blade of the terminal is completely formed before being swaged.

The operator slips the pocket end of the terminal over the end of the cable and places the terminal between the open dies. The terminal is located by inserting the blade end into a slotted stationary mandrel located at the rear of the dies. A pedal starts the machine through the cycle, after which a terminal is swaged on the other end. The locating mandrel prevents the terminal from turning or twisting while being swaged. If the tubular type terminal is to be swaged onto the cable, a spring collet that is opened and closed by compressed air is employed. Collets for the tubular type of terminals and the slotted adapters for the blade type are interchangeable in the locating mandrel.

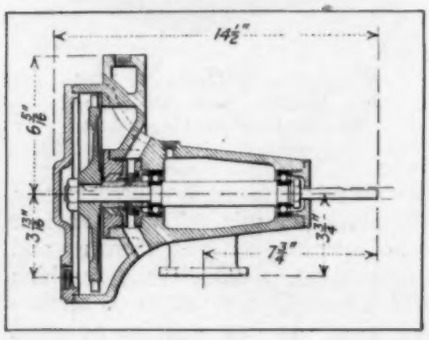
The special swaging head incorporates a mechanism inside of the swaging spindle for opening the dies a sufficient amount to permit insertion of the largest terminal of the blade type between the dies while they are revolving. Two speeds are provided, one to give an output of 9 per min. for the small terminals, and the other of 6 per min. for the large terminals. The machine covers a floor space of 5 ft. x 8 ft., has an over-all height of 5 ft., and weighs 8,000 lb.



Langelier Semi-Automatic, Die-Opening Swaging Machine furnished to the General Electric Company for swaging copper terminals onto the ends of insulated flexible wire cables

## Coppus Fractional-Horsepower Steam Turbines

Designed primarily for unit-heater drives, a fractional-horsepower steam turbine has been developed by the Coppus Engineering Corporation, Worcester, Mass. The turbine is




equally applicable to other units requiring an economical fractional-horsepower prime mover. It is said to be lower in initial cost than an electric motor drive and eliminates electric current costs and accessories.

In the case of unit heaters, high pressure steam is supplied and the exhaust steam is used in the heater. Because it is possible to run the fans at higher speeds with a turbine, fewer unit heaters need be employed than with a motor-driven installation. The steam turbine uses less steam for operation than the unit heater can condense under the worst conditions, and for this reason no excessive back pressure is built up. A small bleeder connection is provided from the live steam supply line of the turbine into the exhaust connection leading from the turbine to the unit heater. If a properly adjusted reducing valve of small size is installed in this bleeder line, a constant, predetermined exhaust pressure will be maintained in the unit heater, and heat will be radiated at a constant rate.

## Niles Locomotive-Axle Journal Grinder

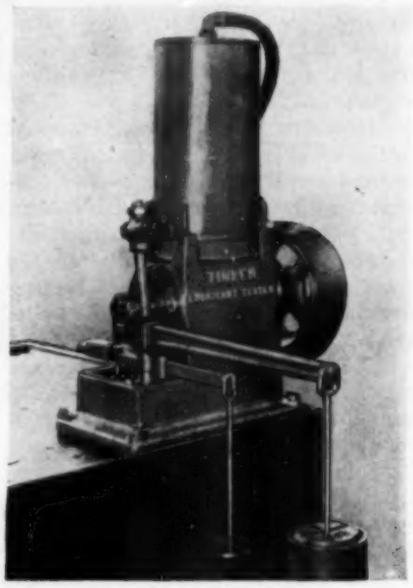
Wheel sets having 90-in. drivers and inside journals from 12 to 18 in. in length can be swung on the locomotive-axle journal grinder announced by The Niles Tool Works Company, Division General Machinery Corporation, Hamilton, Ohio. The machine is arranged with a combination grinding and cutting rest for either independent or simultaneous refinishing of inside journals. It can also be arranged with a similar rest for refinishing outside journals. Floor-to-floor production time for wheel sets having average length journals is 30 min.

The grinding unit is located at the rear of the rest and cutting tools at the front of the rest. Cutting tools are essential as they can be found useful for facing hub liners and also for taking an initial cut over badly worn or scored journals to lessen the amount of material to be removed by the grinding unit. Precautions have been taken to protect the wearing surfaces from the abrasive, and attention has been given to the control of the fluid compound and the proper collection of this fluid in the bed for recirculation.

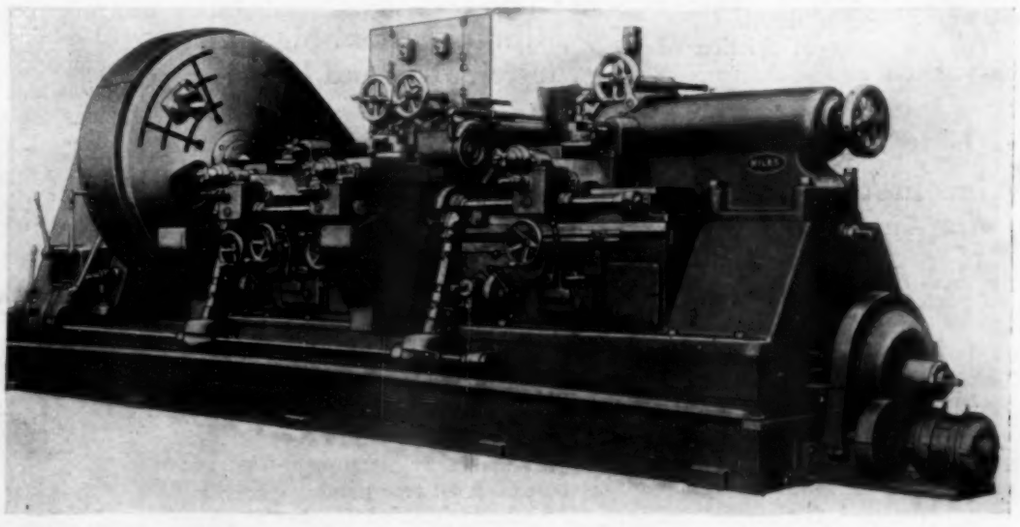
## Timken Lubricant Tester

Testing the load carrying capacity of lubricants is the function of the testing equipment announced by the Timken Roller Bearing Company, Canton, Ohio. Its usefulness is not confined to laboratory or automotive work, as it is equally suitable for use in industrial plants. In addition, it can be used to obtain data on the relative efficiency of different bearing metals under various conditions of load, speed, temperature, or with different lubricants.

Simple construction of this testing equipment makes training or skill unnecessary to produce accurate results. It consists essentially of a cast-iron base which supports the testing mandrel, two levers, and a container holding about a gallon of lubricant. The tank is mounted on top of the base, and just under it is an electric heater, used to raise the



oil to any desired temperature up to 210 deg. F. The oil flows from the tank, over the test piece and to a sump in the base by gravity, the rate of flow being adjusted by means of a valve. From the sump, the oil is pumped back to the tank by a small pump located in the base, and belt driven from the testing mandrel. The latter extends through the base, and may be either direct or belt driven by a variable-speed, fractional-horsepower motor. The mandrel is mounted in two Timken bearings and



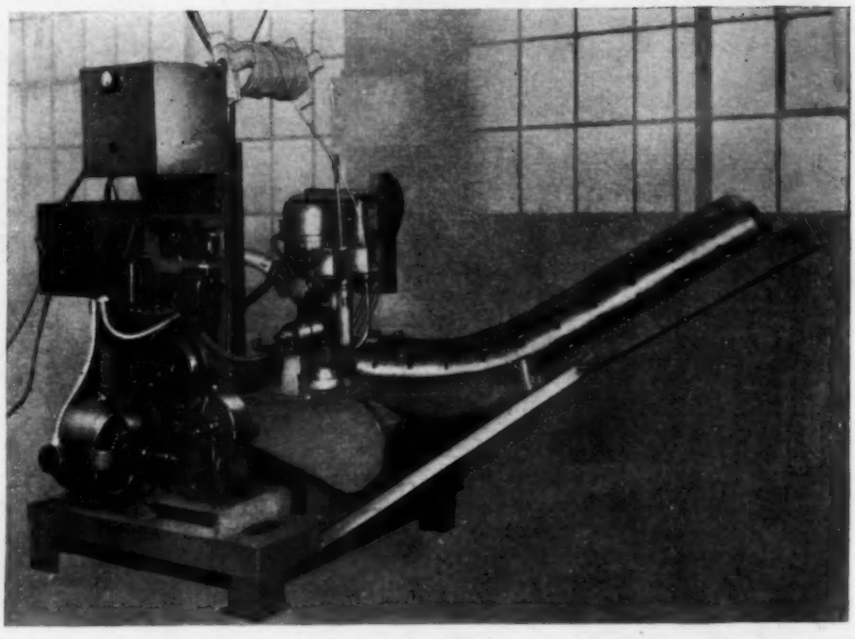
**Cutting tool rests and grinding units are both provided to take care of badly scored or worn journals**

is tapered at the test end to receive the tapered cup of a Timken bearing. This cup, which forms one of the test pieces, is held in place firmly by a nut on the end of the mandrel.

The lever system employs two levers, one above the other. The upper is called the load lever, and the lower the friction lever. The upper, which carries the test block, is pivoted on the knife edge mounted in the lower lever. The latter is also pivoted on a knife edge and is provided with a stop at the unloaded end. Through this arrangement the test block is always parallel to the revolving cup and the unit loading over the length of both pieces is always constant. The test block is a small piece of metal about ½-in. square by ¾ in., hardened to Rockwell C-60 and ground. It is inserted in a notch in the loading lever and held in place by a wedge. Where bearing metals are to be tested, the test block or the cup, or both, can be made of the appropriate material.

With both test pieces in place, the driving motor or line shaft is brought up to the desired speed, and the lubricant heated to the required temperature, is allowed to flow over the test block. The loading lever is then loaded by means of weights until the desired unit pressure is obtained between the test pieces. A chart is furnished with the apparatus to give the necessary weights on the loading lever per 1,000 lb. of unit pressure. If only the load carrying capacity of the oil is to be determined, the test block is removed after 30 min. running, and examined for signs of scuffing. The degree of scuffing determines the relative load carrying capacity of the lubricant.

The coefficient of friction of the lubricant can also be determined.

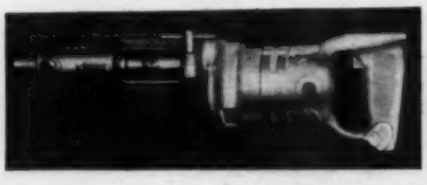


## Lincoln Automatic Welder for Automobile Starter Frames

Approximately 240 automobile starter frames per hour can be welded on the automatic machine illustrated. This unit, placed on the market by The Lincoln Electric Company, Coit Rd. & Kirby Ave., Cleveland, Ohio, embodies the principle of the shielded arc and utilizes the "Electronic Tornado" process. The starter and generator frame are usually made of $\frac{5}{16}$ or ⅜ in. plate cut to size and shape, punched and rolled into cylinders before being arc welded. These cylinders are fed into a gravity conveyor, and guided automatically to keep the seams on top. At the bottom of the gravity conveyor, they pass between two rolls which squeeze the seams together tightly as they pass under the arc. No filler rod is required, the two edges of the seam being fused together. One man and a helper can operate four machines simultaneously, giving a cost per frame of ½ cent each. The welds made are of high tensile strength and ductility with pleasing appearance.

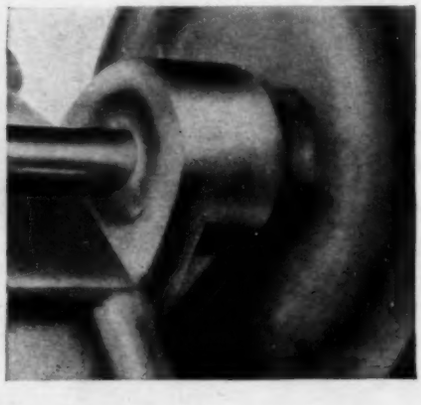
## Milwaukee Combination Electric Drill and Hammer

Holes up to $\frac{5}{16}$ in. in steel and up to 1 in. in concrete or brick can be drilled with the combination tool developed by the Milwaukee Electric Tool Corporation, Milwaukee, Wis. The hammer attachment is constructed with two moving parts, and is made to fit a full ball-bearing electric drill operating at high speed. This attachment is designed so that it can be easily attached to the drill without the use of tools. It delivers 3,600 blows per minute, and will drill a ½-in. hole in concrete up to 2½ in. deep in 1 min. The weight is 9½ lb.



## Federal All-Geared Presses Equipped With Roller Bearings

As standard equipment on the all-geared type of presses, the Federal Press Company, Elkhart, Ind., has applied Timken roller bearings in the backgear bracket. The bracket is cast integral with the frame and the Timken roller bearings are built into adjustable housings. Decreased power consumption is a feature of this construction, and wear is minimized. Two bearings are used in each housing.



# Rivett Improved No. 608 Backgeared Precision Screw-Cutting Lathe

Several improvements have been made in the drive and control of the No. 608 backgeared, precision screw-cutting lathe manufactured by the Rivett Lathe & Grinder Corporation, Brighton, Boston, Mass. This machine is available fully enclosed in an oak cabinet with space for accessories, as shown in Fig. 1, but may also be obtained mounted on a bench and having the same type of drive and control.

One improvement is the magnetic starter at the front of the lathe. This starter embodies start, stop, and reverse buttons, and the handle at the front has slow-speed, neutral, and fast-speed positions. This handle may be thrown back to neutral by contact with the operator's body without requiring him to use his hands. Shifting of belts on the three-step cone is done by pulling out a bar protruding from the left side of the cabinet. This bar controls shifting the belt on the driven pulley in the cabinet and eliminates hazard to the operator. The knob is at the left of the contactor.

The speed-box drive now employs two V-belts instead of chains, and the motor is mounted on a hinged plate to provide belt adjustment by means of a screw. Vibration has been eliminated and quietness in operation obtained by mounting the bench lathe on granulated cork board and the speed-box drive in the same manner. A Super Johnson friction clutch of the double-end variety is employed in the speed-box.

Other improvements have also been made in the line of bench lathe drive equipment. The overhead countershaft is now equipped with ball bearings and the jack-shaft is likewise equipped, as well as the horizontal safety drive.

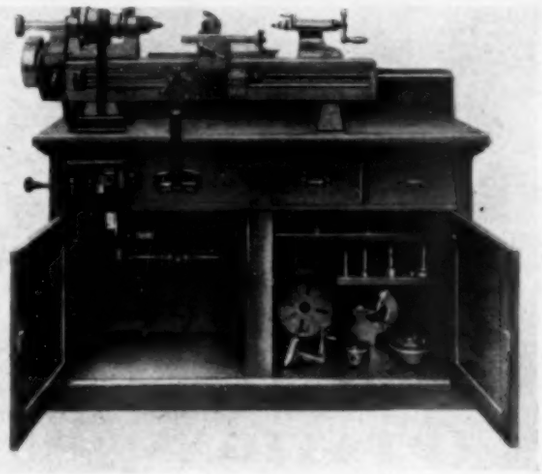


**Fig. 1—A magnetic contactor and the speed-control handle at the front afford easy operation of the Rivett Improved No. 608 Precision Screw-Cutting Lathe**

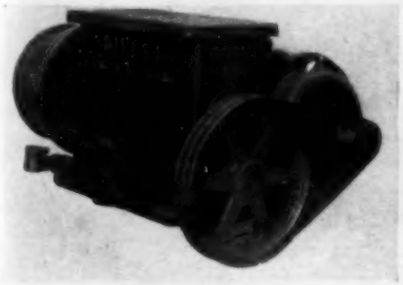
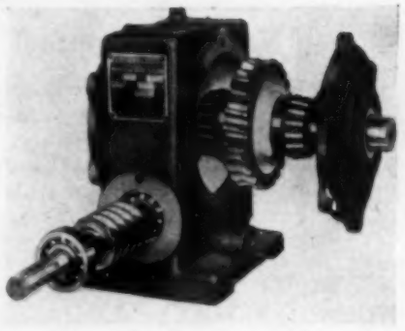


**Fig. 2—V-belt drive is now employed for the speed box, and the hinged motor mounting permits take-up of the belt stretch**

## Horsburgh & Scott Small Wormgear Speed Reducers

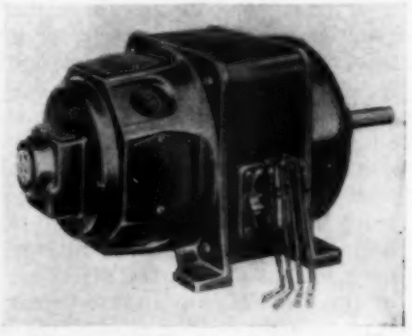
Two small speed reducers of wormgear design have been placed on the market by The Horsburgh & Scott Company, 5114 Hamilton Ave., N. E., Cleveland, Ohio. These reducers are designated as series WB-600 and WB-700 and deliver maximum torques on the gearshaft of 1,100 and 2,140 in.-lb., respectively. Both are available in ratios from $4\frac{1}{6}$ to 1 up to 60 to 1 and with wormshaft speeds from 300 to 3,000 r.p.m. Running at a wormshaft speed of 1,800 r.p.m. the 10 to 1 WB-600 reducer will have a horsepower rating of 2.1 and the WB-700 a rating of 2.6 hp.



As shown by the illustration, the worm shaft is mounted on roller bearings and the wheel shaft on roller bearings of the tapered variety. The worm is forged integral with the shaft and the threads are hardened, while the top, bottom and sides of threads are ground after hardening. The face of the solid bronze wormgear is extra wide. The housing is a gray-iron casting made in one piece, with the gear introduced through the side. Where it is desired to have the speed reducer and motor mounted together, bedplates of welded steel are supplied.

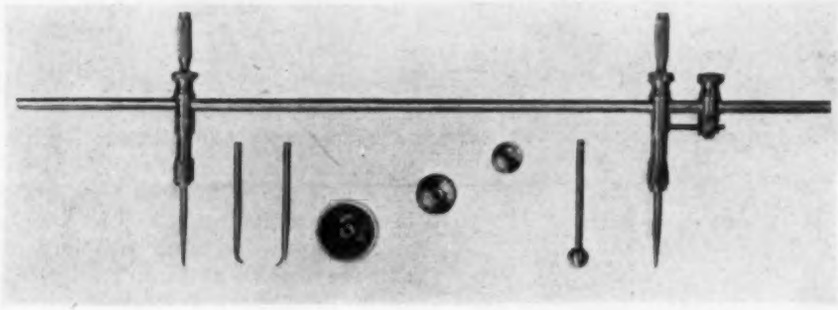
## Robbins & Myers Box-Frame Motors

Box-frame motors in sizes from $\frac{1}{2}$ to 3 hp. are now available from Robbins & Myers, Inc., Springfield, Ohio, and Brantford, Ontario. They are compact, powerful, and have semi-enclosed end heads, as shown in the illustration. Mounting dimensions are the same as for repulsion induction, single-phase, polyphase, and d.c. types having similar ratings and speeds. An improved wool yarn bearing lubrication system is standard, but ball-bearing motors are built on special order. These motors are carried in stock.



## Starrett No. 251 Trammel

For metal workers and draftsmen, the L. S. Starrett Company, Athol, Mass., is introducing a No. 251 trammel employing a beam made of steel rod to prevent inaccuracies from bending. The beam is flattened on



top so that the trams, once clamped in position, have no tendency to turn when pressure is applied to the points. One of the trams has an adjusting screw that permits fine adjustments. Setting of the points is made easy by a spring friction which holds the trams in place when the nuts are loosened. The knurled grips are in the form of rollers which turn freely with the fingers as the arc is scribed. The trammel points are adjustable in the spring chucks and can be replaced by pencils, caliper legs, or ball points. The ball points permit working from holes up to 1½ in.

The No. 251 trammel is supplied with steel beams of various lengths to scribe circles of 18, 26 and 36 in. in diameter. In addition, an extra 20-in. beam with a rigid coupling is obtainable for circles to 72 in.

# EQUIPMENT ADAPTATIONS

### RECENTLY DEVELOPED BY THE MAKERS

## Ex-Cell-O Special Horizontal Drilling, Reaming and Tapping Machine

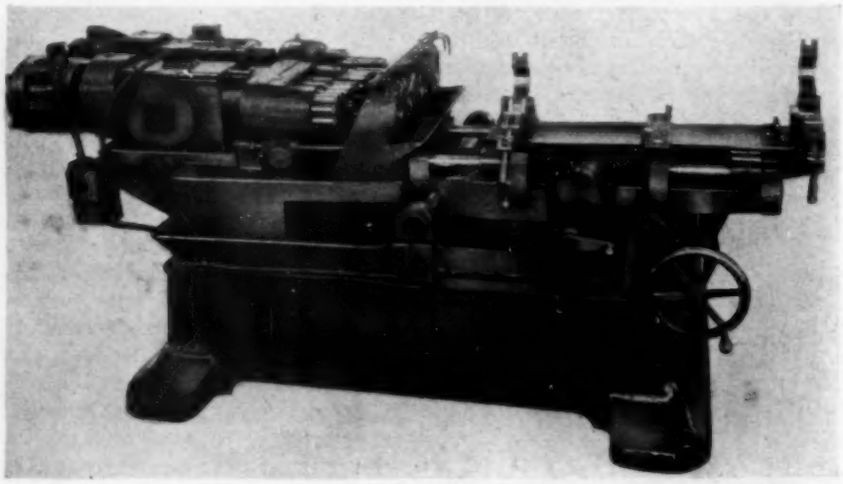
Eight holes in a rear-axle housing are drilled, reamed, and tapped in the special horizontal machine illustrated. This unit, built by Ex-Cell-O Aircraft & Tool Corporation, Krueger Division, 1200 Oakmand Blvd., Detroit, Mich., consists of four groups of spindles performing all operatings from drilling to tapping complete the holes in the end flanges for a rear-axle housing approximately 66 in. long. It consists of two semi-automatic units, one for the drilling operations and step reaming, while the other unit taps all holes. The first unit consists of a 20-spindle multiple head and is mounted on the drilling unit. This head is provided with two horizontal rack guide bars with equalizing pinions and shafts. It consists of three banks of spindles, the first bank of eight drilling eight 27/64-in. holes, the second group of four drill four 29/64-in. holes, and the third group of eight step-ream eight ½ in. holes ⅛-in. deep and the $\frac{7}{16}$-in. holes entirely through. The eight-spindle tapping head is for tapping eight ½-in., 20-thread holes in one operation.

The fixture consists of a compound table indexed to the right and at the same time moving to the loading position. The part is located in two V's and clamped by an adjustable cam. A central equalizing interrupter is provided so that the part can be tilted to the proper angle when drilling either end. After locating the part, the table is moved to the left to the drilling position and held by a jig lock connected directly to the operating handle. The drilling unit is then started by pressing a button.

After the drilling operation, the cross-slide is indexed to the second drilling position. This cross indexing is accomplished by releasing the indexed plunger in the center of the cross-side and turning the handwheel.

## Rehnberg-Jacobson Automatic Drilling, Tapping, and Cut-Off Machine

An automatic machine for drilling and tapping two No. 10/32-in. holes and drilling a third and smaller hole at right angles to the first two in a small brass piece, $1\frac{1}{16}$ in. long, has been built by the Rehnberg-Jacobson Manufacturing Company, Rockford, Ill. The piece is a component of an electric refrigerator, and the final operation is to saw it from the $\frac{7}{16}$-in. square brass stock fed in rod form.

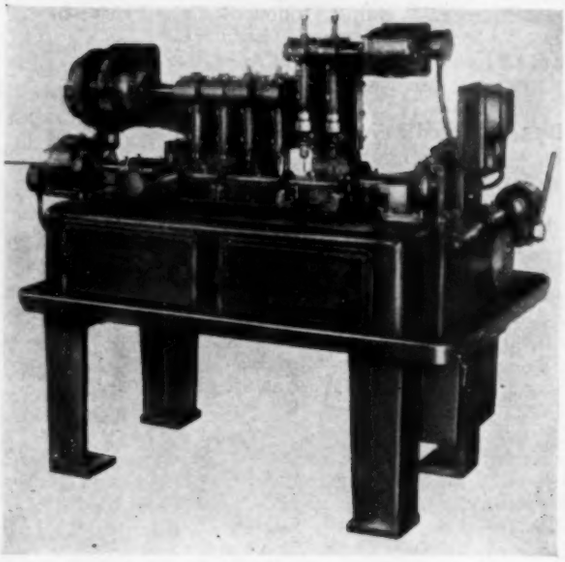


**Special horizontal 4-position machine built by Krueger Div., Ex-Cell-O Aircraft & Tool Corporation for drilling, step-reaming, and tapping eight holes in a rear-axle housing**

All movements are cam controlled, and six motors are used for driving the feed and the ten heads.

The chief requirement is that the holes be spaced accurately, within ±0.002 in. For this reason the stock is fed up against a stop by a cam-actuated spring grip device.

With the first head, the small cross hole, 0.1252 + 0.0, — 0.0003 in. in diam., is drilled and one side countersunk; with the second, the same hole is reamed and the other side countersunk.



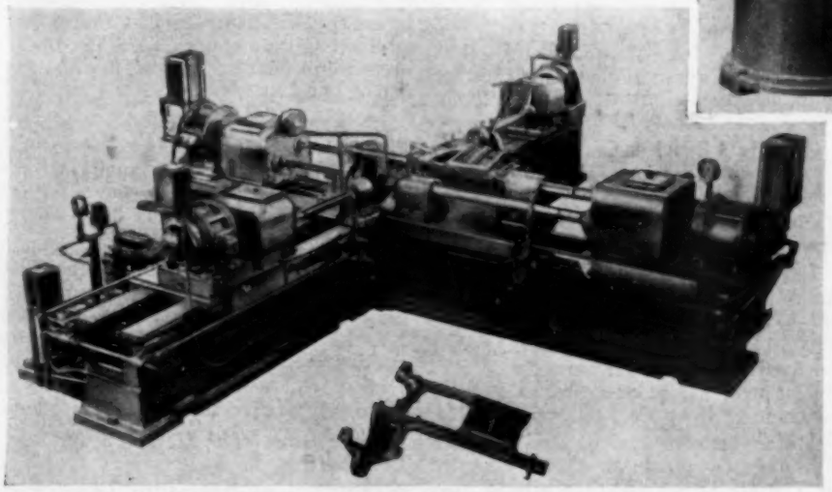
Rehnberg-Jacobson Three-Operation Machine

The next four vertical heads are mounted on a base integral with the cam-actuated head slide. There is also another pair of spindles that are placed diametrically opposite them to chamfer on both sides the larger holes drilled by the first pair of vertical spindles preparatory to the tapping operation, which follows in another pair of vertical spindles. A milling saw cuts off the piece.

## Defiance Special 4-Way Horizontal Boring and Reaming Machine

Boring all right-angle holes and reaming the ends in a grass mower frame at one operation is done on the special 4-way horizontal boring and reaming machine illustrated. This machine, built by the Defiance Machine Works, Defiance, Ohio, is equipped with an Oilgear feed and can be built with the spacing of spindles in the heads and number of spindles to suit requirements. On the type of work mentioned, the machine will give a production of 12 units per hour.

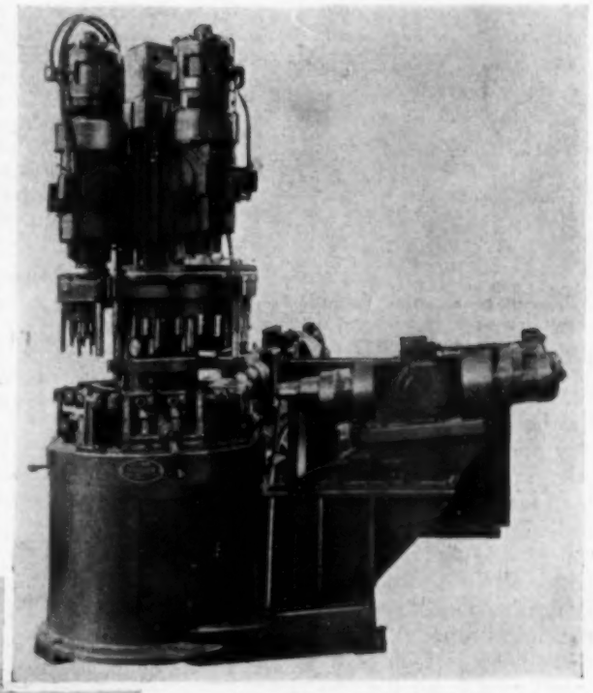
The base is made in three sections. The multiple-spindle heads are mounted at right angles on the machine and driven by means of heat-treated gears. A removable fixture is equipped with guide bushings for the boring bars. It has quick-acting adjusting screws and clamps for holding the casting in position. One man can operate the machine, as all controls are located at the front.



Hydraulic feeds are employed on this Defiance Machine

## Ex-Cell-O Semi-Automatic Drilling, Reaming, Counterboring, and Tapping Machine

All holes in a steering-gear case are finished by this machine in one loading. The holes vary in size and location, part of them being at right angles to the others. The machine, built by the Ex-Cell-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit, Mich., is of the semi-automatic type for drilling and reaming two holes; drilling, countersinking, and tapping three holes; counterboring a large recess in the top face and roughing and finishing a small counterbore in the barrel-end of the part.



Five units are built into this Ex-Cell-O machine

Three multiple-head motor-driven units are mounted on the vertical column, with two additional multiple

units placed at the side. Fixtures for holding the parts are mounted on an automatic, rotary table. Each fixture holds two parts located horizontally over a plug that is flattened both top and bottom. It is forced back against the end of the plug and up against the large flat face by means of an equalizing clamp operating through a pinion and jig lock. By registering the large flat face against the end of the plug, the accuracy of location between the hole in the barrel and the two dowel holes in the large flat face is held to within plus or minus 0.001 in. Dowel holes are $\frac{11}{16}$ and $\frac{3}{8}$ in.

At the first of the five operating stations, the large recess in the flat face is counterbored and one of the heads mounted in an angular position

**Steering-gear case drilled, reamed, counterbored and tapped on Ex-Cell-O machine**

rough counterbores the long hole in the body. The counterbore used in this operation is aligned by a roller pilot in the main locating plug. At the second station five holes are drilled in each part, four holes on the top of the flat face and one on the bottom. In addition, the long bore is finish counterbored by the second multiple head. At the third station, three holes in each of these parts are countersunk and the two dowel holes are reamed, while at the fourth station three holes are tapped. The fifth station is the unloading station.

# PATENTS

FEBRUARY 3, 1931

**Metal-Working Machinery**

Feed Mechanism for Bar and Tube Grinding Machines. Arthur J. Koon, Grand Rapids, Mich. *Patent 1,790,668.*

Work Rest for Bar and Tube Grinding Machines. Arthur J. Koon, Grand Rapids, Mich. *Patent 1,790,669.*

Machine for Welding Hollow Bodies Under Abnormal Pressure. Arthur C. Badger, Newton, Mass. *Patent 1,790,787.*

Operating Mechanism for Hydraulic Presses. Mark H. Damerell, Worcester, Mass., assigned to Wyman-Gorden Co. *Patent 1,790,797.*

Automatic Lathe and Blank-Feeding Means Therefore. Edwin R. Smith and Albert Schinkez, Seneca Falls, N. Y., assigned to Seneca Falls Machine Co. *Patent 1,790,848.*

Metal-Working Machine for Multiple Drilling. John W. Mullin, Mount Vernon, Ohio. *Patent 1,790,943.*

Brake-Band-Drilling Machine. Robert E. Manley, York, Pa., assigned to Manley Manufacturing Co. *Patent 1,790,072.*

Apparatus for Cleansing Metal Sheets. Charles H. Manion and Charles W. Kinter, Follansbee, W. Va. *Patent 1,790,101.*

Spring-Nesting Mechanism for Coiling Machines. Corban H. Ziler, Carthage, Mo., assigned to L. A. Young Spring and Wire Corporation. *Patent 1,791,257.*

Rotary Feed Device for the Work Spindles of Tool-Grinding Machines. Kurt Metzler, Gorssenhain, Saxony, Germany. *Patent 1,791,424.*

Grinding Machine. John E. Caster, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. *Patent 1,791,442.*

Cam-Grinding Apparatus. Herbert A. Silven, Worcester, Mass., assigned to Norton Co. *Patent 1,791,479.*

**Tools and Attachments**

Burnishing Device. John J. Thather, Wethersfield, Conn., assigned to The F. B. Shuster Co. *Patent 1,790,731.*

Chuck. Albert E. Church, New Britain, Conn. *Patent 1,790,744.*

Rotatable Head for Rivet-Spinning Machines. William B. McNaughton, Fairfield, Conn., assigned to The Grant Manufacturing Co. *Patent 1,790,829.*

Attachment for Machine Tools. Fred S. Haas, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. *Patent 1,790,857.*

Apparatus for Manufacturing Rail Anchors. Norman E. Sampson, Canton, Ohio, assigned to Canton Forge & Axle Co. *Patent 1,790,951.*

Caliper. Charles Larson, Chicago, Ill. *Patent 1,790,989.*

Drill Support. Robert E. Manley, York, Pa., assigned to the Manley Manufacturing Co. *Patent 1,791,073.*

Expansible Reamer. Floyd S. Hartwell, Lakewood, Cleveland, Ohio. *Patent 1,791,205.*

Workholder. Julian L. Perkins, West Springfield, and Hiram D. Croft, Springfield, Mass., assigned to Perkins Machine & Gear Co. *Patent 1,791,224.*

Motor Traverse for Lathes. William F. Groene, Cincinnati, Ohio, assigned to The R. K. Le Blond Machine Tool Co. *Patent 1,791,270.*

**Processes**

Method of Electric Welding Thick Metal Plates. Birger Torvald Andren, Milwaukee, Wis., assigned to A. O. Smith Corporation. *Patent 1,790,738.*

Method of Making Plugs. Seth G. Malby, Tenafly, N. J., assigned to Aluminum Screw Machine Products Co. *Patent 1,791,035.*

Method of Forging. Charles A. Brauchler, Canton, Ohio. *Patent 1,791,187.*

**Furnaces**

Furnace Wall. Oscar Nygaard, Saugus, Mass. *Patent 1,791,244.*

Metallurgical Furnace. Frank A. Fahrenwald, Chicago, Ill. *Patent 1,791,404.*

# TRADE PUBLICATIONS

Compressor Control. The Pennsylvania Pump & Compressor Co., Easton, Pa., is distributing General Bulletin No. 102 entitled "Dual Compressor Control."

HEATING FURNACES, BOX-TYPE. Ryan, Scully & Co., Philadelphia, Pa., are distributing bulletin 5H on the types A and B portable box-type electric heating furnaces, covering general construction, control apparatus, and specifications.

LUKENWELD CONSTRUCTION. Lukenweld, Inc., Div. of Lukens Steel Co., Coatesville, Pa., has published an illustrated bulletin under the above name and showing the many types of machines to which shape-cutting and fabricating methods have been applied.

NEW ENGLAND COUNCIL REPORT. The New England Council, Statler Bldg., Boston, has published the Fifth Anniversary Issue of the New England News Letter, which shows among other interesting information that more than a billion and a quarter dollars have been invested in that section of the country during the last five years.

PLANER ANALYSIS. The Cincinnati Planer Co., Cincinnati, Ohio, has prepared "An Engineering Analysis of a Planer Problem Showing the Possibilities of a Modern Machine."

SAFETY ACTIVITIES. The Metropolitan Life Insurance Co., Policyholders Service Bureau, 1 Madison Ave., New York, N. Y., has issued pamphlet No. 10 in its industrial safety series entitled "Safety Activities in Small Companies," where the accident rate is frequently higher than in larger plants.

WIRE ROPE. The Hazard Wire Rope Co., Wilkes-Barre, Pa., has issued a pamphlet on "Korodless" wire rope made of chrome-nickel steel.

# NEWS OF THE WEEK

## 1930 Metal-Working Machine Exports Set New High Total

WASHINGTON, D. C., Feb. 7—Forging ahead from a total of $19,000,000 in 1926, a record export total of $42,000,000 worth of American metal-working machinery was written up for 1930, according to the Industrial Machinery Division, Bureau of Foreign & Domestic Commerce. This increase of $23,000,000 annual business in a 4-year period, and an advance of $1,200,000 over 1929 is indicative of the foreign demand for high-production metal-working machinery. This is economically significant, as next to Canada, Europe is our best customer, and to some extent our most severe competitor in certain types of metal-working machinery. The demand for high-production tools and machines of the first quality is supplied, however, chiefly from the United States, where the quality of mass production machinery of this class has been tried and proved. Great Britain and Germany are finding it increasingly necessary to use these high quality machines even in preference to their own for volume-production results.

1930 exports of industrial machinery, though indicating a decline of about $30,000,000 as compared with the unusual 1929 record, exceeded any previous year since the post-armistice period of abnormalcy, and totaled nearly $227,060,000. This represents a gain of 8.4% over 1928, and is more than double similar American exports in 1922.

Economic upheaval during the closing months of 1929 did not seem to affect exports of industrial machinery during the first half of 1930. Exports from January to June, 1930, totaled $136,569,000, against $129,299,000 for the first six months of 1929, and $127,786,000 for the second half of 1929. Unemployment abroad, disrupted finances, lack of confidence in the future, political revolutions in several of the Latin American countries and in Europe, and unsettled political and business conditions in the Far East, reflected in Europe and throughout the world, have contributed to the decline in American machinery exports which has continued since July. These features of the world market forming the background of the industrial machinery trade of the world have been given study in a Bureau publication, now on the press and to be issued shortly, entitled "Industrial Machinery, 1930." An understanding of the importance of the present decline in the machinery exports of the past six months, ending in December with a shipment of only $13,051,000 worth of industrial machinery, as against $24,000,000 worth in January, 1930, in a non-seasonal trade, can be aided by study of this booklet, due to be issued as "Trade Promotion Series No. 111."

UNITED STATES EXPORTS OF INDUSTRIAL MACHINERY, 1926-1930

| Class of Machinery | 1926 | 1927 | 1928 | 1929 | 1930 |
|---|---|---|---|---|---|
| | (Dollars value) | | | | |
| Power Generating, except electric and automotive: | | | | | |
| Steam engines | [1]9,598,525 | 9,559,909 | 7,757,381 | 7,664,907 | 5,350,847 |
| Internal combustion engine | [2]5,954,343 | 7,738,356 | 8,990,126 | 11,358,910 | 9,464,520 |
| Water wheels and water turbines | 253,559 | 212,412 | 739,763 | 355,865 | 762,837 |
| | 15,806,527 | 17,550,677 | 17,487,270 | 19,379,682 | 15,578,204 |
| Construction and conveying machinery | 17,046,987 | 19,127,172 | 22,791,005 | 26,485,310 | 25,490,933 |
| Mining, Oilwell and Pumping Machinery: | | | | | |
| Mining and quarrying | 14,857,106 | 13,190,061 | 14,059,502 | 17,953,877 | 15,783,811 |
| Oil-well and refinery | 15,303,058 | 16,842,638 | 16,192,804 | 25,004,481 | 23,817,145 |
| Pumping, power | [3]5,271,261 | 5,550,481 | 5,438,654 | 7,023,964 | 5,365,318 |
| | 35,431,425 | 35,553,180 | 35,691,050 | 49,982,322 | 44,946,271 |
| **Metal-Working Machinery[3]:** | | | | | |
| **Power driven** | ..... | **20,129,294** | **27,421,463** | **33,438,723** | **35,489,749** |
| **Other** | ..... | **4,901,887** | **6,703,346** | **7,364,670** | **6,516,230** |
| | **18,968,143** | **25,031,181** | **34,124,809** | **40,803,393** | **42,005,979** |
| Textile Sewing and Shoe Machinery: | | | | | |
| Textile machinery | 10,400,268 | 11,465,553 | 12,856,861 | 13,657,081 | 8,660,516 |
| Sewing machines, industrial | 3,123,420 | 4,368,951 | 4,250,054 | 4,885,506 | 3,643,651 |
| Shoe machinery | 1,353,210 | 1,718,347 | 1,740,497 | 1,988,384 | 1,677,956 |
| | 14,876,898 | 17,552,851 | 18,847,412 | 20,530,971 | 13,982,123 |
| Other industrial machinery | [4]54,602,081 | 68,005,390 | 80,508,113 | 99,903,624 | 85,056,363 |
| Totals | 156,732,061 | 182,820,451 | 209,449,659 | 257,085,302 | 227,059,873 |

[1]Excludes locomotives and locomotive parts.
[2]Excludes engines not over 10 horsepower.
[3]Excludes windmill pumps also parts of pumps.
[4]Includes mine cars and refrigerating sets up to 1 ton.

U. S. EXPORTS OF INDUSTRIAL MACHINERY BY MONTHS—FIVE YEARS

Thousands of Dollars

| Month | 1926 | 1927 | 1928 | 1929 | 1930 |
|---|---|---|---|---|---|
| January | 13,241 | 14,946 | 15,123 | 20,434 | **24,100** |
| February | 10,997 | 12,467 | 15,060 | 19,568 | **20,451** |
| March | 12,781 | 14,949 | 17,304 | 24,924 | **23,341** |
| April | 16,100 | 17,612 | 16,117 | 22,310 | **24,039** |
| May | 12,274 | 15,160 | 19,320 | 20,658 | **23,036** |
| June | 11,115 | 14,207 | 18,647 | 21,405 | **21,002** |
| July | 14,173 | 17,120 | 19,191 | 21,335 | **18,117** |
| August | 11,821 | 16,070 | 17,694 | 21,351 | **15,745** |
| September | 14,391 | 13,251 | 13,343 | 21,811 | **15,902** |
| October | 11,515 | 15,621 | 18,664 | 23,025 | **13,655** |
| November | 14,628 | 15,855 | 20,352 | 20,311 | **14,021** |
| December | 13,696 | 15,562 | 18,635 | 19,953 | **13,051** |
| Total | 156,732 | 182,820 | 209,450 | 257,085 | **227,060** |

## Foundation to Sponsor High-Temperature Studies

Among the technical undertakings in which the Engineering Foundation will co-operate in 1931 is a two-year investigation of the effects of high temperatures on metals by the A.S.M.E. and the A.S.S.T. At the request of the A.I.E.E., the Foundation is aiding an investigation of pure iron electrodes to obtain basic data of use to electric welders. Other research enterprises of the Foundation include alloys of iron at the Battelle Memorial Institute, U. S. Bureau of Standards, Carnegie Institute of Technology, and Lehigh University; fundamental properties of dielectrics, at Johns Hopkins, and wood painting at the U. S. Forest Products Laboratory.

## Professional Societies Have Job Services

The American Trade Association Executives and the National Engineering Societies have rosters of a number of well-qualified business executives and technicians, many of them without a position because of the present economic condition. Information regarding the executives available may be obtained from the American Trade Association Executives, 45 East 17th St., New York, N. Y. Information on professional engineers or technicians may be obtained from Walter V. Brown, Engineering Societies Bldg., 31 West 39th St., New York, N. Y. The work is a free contribution to industry by the professional organizations.

# French Metal-Working Activity Continues Its Decline

**By Our Paris Correspondent**

FRANCE'S unemployment roster is still growing, and prospects are not particularly favorable. Taxes, already high, were being raised to meet the decline in collections, a movement which industry could not support, so Tardieu's cabinet was displaced. But industrial activity and foreign trade are still shrinking perceptibly, probably indicating France's entry into its critical period. And France is less well prepared to support it than most other countries.

Monsieur Caillaux, war-time Minister of Finance, has admonished his country to beware a war of tariffs. "Before the war, Europe was a vast factory," said he, "making goods for mutual exchange and the supplying of other competitive markets, whereas now all countries are not only trying to be sufficient unto themselves by applying protective measures to keep their markets free from foreign attack, but still expect to sell elsewhere. France, too, is trying to tie up two far-flung loose ends. While the over-built, post-war industrial north may be active, it ignores the possibility that customers may not exist."

It is not encouraging to believe that too much has been invested in production goods and too little effort made to reduce prices on manufactured consumer goods, but this appears to be the case. The foundry industry is working moderately on urgent deliveries and special machinery manufacturers are finding some current business. There is not much possibility of large-scale automobile output. The electric motor industry is running steadily, but not at capacity. Railway rolling stock activity is principally on orders already in hand, little new business having materialized as yet.

Excessive imposts and taxes, more than labor charges or overhead, affect the price of French manufactured goods above that of imports, even after heavy tariffs. For example, the American automobile has from 30 to 50 per cent the advantage in price.

Eleven months French foreign trade statistics for 1930 show that exports fell from 37,295,280,000 francs in 1929 to 31,564,192,000 francs, roughly 20 per cent. Import figures were respectively 46,769,730,000 francs and 42,053,437,000 francs. Each group is eloquent in its own sphere; the first represents a deficit in manufactured goods exported, the second a deficit in raw materials for industry and production goods imported. Exports to French Colonial markets held their own.

Imports from the United States show a loss in value of nearly a billion francs. There was less of a discrepancy in the showing of Great Britain, but a far greater one in that of Germany. The latter indicates that some sort of an efficient brake has been put on "reparations" imports from Germany. Imports from Soviet Russia have increased, the most recent notable bulk being in automobile tires—presumably turned out with American machinery.

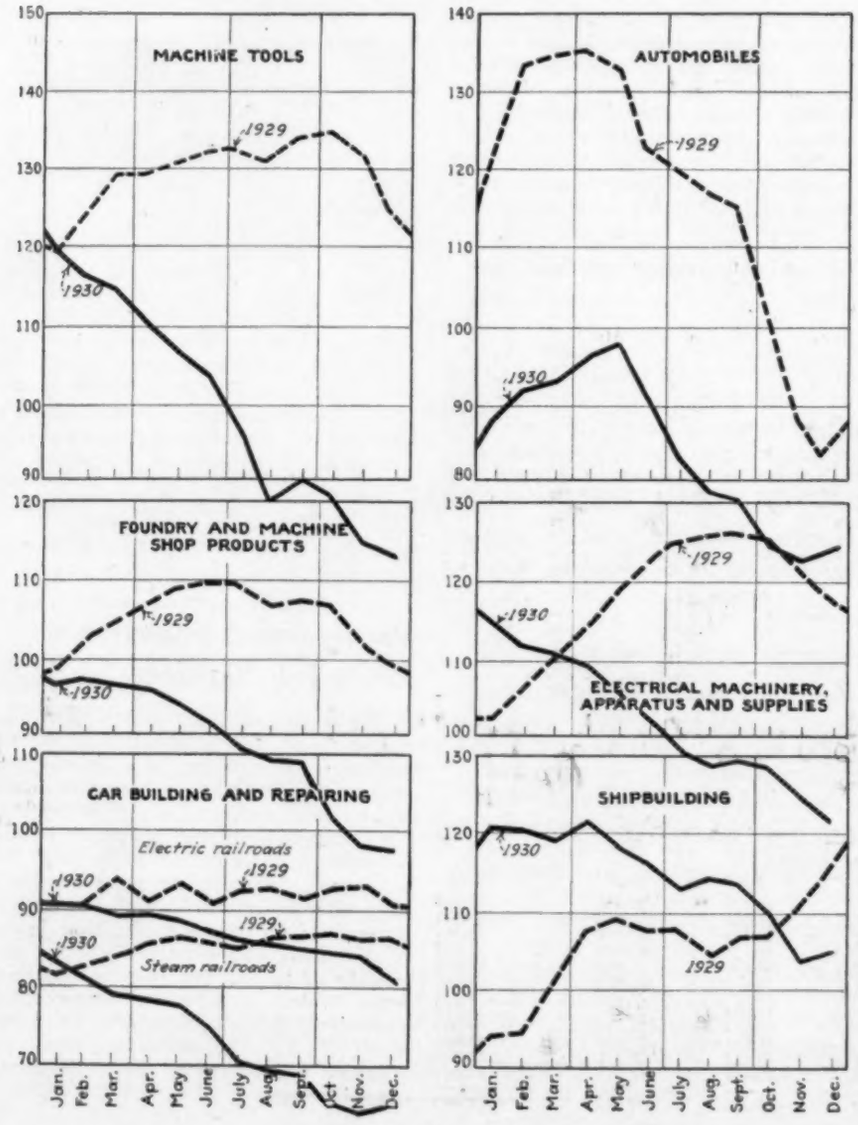
The obvious growth of unemployment is bringing in its train the problem of caring for the unemployed, believed to be growing at the rate of 2,000 a week at the moment. France has no compulsory unemployment insurance as has Great Britain, Germany, and Italy.

Wages are higher in the metallurgical industry and the transforming metal trades than the co-efficient of 5 by which the stabilized franc is reckoned. Pattern makers in foundry trades stand at the index of 647; machine fitters, 658; boiler makers, 716; electric machinery trades, 681. Apart from specialist labor the general wage stands at 582 in steady employment, while the day laborer is paid on the basis of 821. The average, taking into account gold prices for living costs, is 123, meaning, then, that the wage earner in France to day is paying 23 per cent more for most of his necessities of life than before the war.

## Trend of Employment In the Metal-Working Industries

**Data Supplied by the Bureau of Labor Statistics**

Monthly average for 1926 = 100



## World Business Meeting Scheduled in May

Business men from the 46 countries represented in the International Chamber of Commerce will meet at the World Business Conference, to be held in Washington from May 4 to 9, according to Silas H. Strawn, Chairman of the American Committee. The feature of the conference will be a discussion of the causes of the present international trade depression and the possible remedies that can be applied to hasten full recovery.

## New England Firms Make Recommendations

More than 70 per cent of those replying to a recent referendum conducted among New England manufacturers and other business interests by the Industrial Committee of the New England Council declare that the first essential to promote employment maintenance is to hold actual lay-off to a minimum and substitute the elimination of overtime and the reduction of weekly hours. Next in order of emphasis is the recommendation to merchandise aggressively by developing new products to meet new or changing needs; by finding new uses for present products; by improving quality and packaging, or presenting the product more attractively; by eliminating slow-selling lines, unprofitable accounts, and territories; and by advertising consistently. The third step is the recommendation that employers maintain employee morale by providing wages and working conditions on levels enabling their employees to prosper as well in New England as they might elsewhere. The fourth measure urged is that people with stable incomes buy for their normal needs. Fifth in the order of importance is general industrial housecleaning, including painting, overhauling, and repairing. The sixth provides for research to discover ways of improving the product or reducing its cost. Other proposals given favor include modernization of plant equipment, elimination of waste, and planning of operations on a long-time basis.

A RECOMMENDATION to all employers of labor in New England that they begin at once accurate recording of the effects of the current depression upon the hours of work and earnings of their employes was adopted by the Industrial Committee of the New England Council at a recent meeting. Chairman of the Council's Industrial Committee is James W. Hook, President of the Geometric Tool Co.

FEDERAL Specification No. 469 on Structural Steel and Rivet Steel, for ships other than naval vessels, is being submitted to industry for comment and criticism. Comments must be received within eight weeks.

AUTOMOBILE output fell 2,003,550 last year, according to the Department of Commerce. December, 1930, production was 155,601, up 35,594 from December, 1929.

STANDARDIZATION of equipment used by American foundries has been decided upon by the American Standards Association. Under the technical leadership of the A.S.M.E. and A.F.A., the project will be given to a working committee representing manufacturers of foundry equipment, government metallurgical specialists, and important branches of the foundry industries, having an annual production of several billion dollars.

# BUSINESS ITEMS

The Western Machine Tool Works, Holland, Mich., has purchased the complete business of the Chard Lathe Co., Newcastle, Ind., and will continue to manufacture this complete line of lathes, ranging in sizes from 16 to 28 in., at the Holland plant.

The Wagner Malleable Iron Co., 1275 East Sangamon St., Decatur, Ill., is now operating on a 5½-day basis and W. W. Wagner, President, indicates that the plant expects to maintain that schedule through the remainder of the year. Production, now at 75 per cent capacity, will be at capacity within a month.

The Pennsylvania Railroad has begun quantity production on its recent $5,000,000 order for 1,500 new steel gondola cars. These cars are the longest of their class ever built, being 70 ft. 3 in. over the couplers, with an inside body length of 65½ ft., and a carrying capacity of 74 tons

The Leland Manufacturing Co., Dayton, Ohio, has established a branch plant at Toronto, Ont., in conjunction with D. M. Fraser, Ltd., Canadian representative. A new company has just been incorporated which will be known as the Leland Electric of Canada, Ltd., of which D. M. Fraser is president.

**One Reason for The Poorest Average**

Railroads were one of the poorest groups in the *American Machinist* 1930 Inventory. An average of 73 per cent of their shop equipment was over 10 years old. Part of the answer is shown in this calendar for 1931. It shows 150 days total receipts for wages, 19 days for locomotive fuel, 66 days for materials and supplies, 26 days for all other operating expenses, 23 days for taxes, 43 days for interest and rents, 28 days for dividends, and only 10 days for reserves and improvements, but 2¼ per cent of total receipts. 1930's figure was 9 per cent. It is easy to see the reason for the poor showing of the railroads.

The Bethlehem Steel Corporation is completing negotiations for acquisition of the McClintic-Marshall Co., of Pittsburgh. Charles D. Marshall, President of McClintic-Marshall, which is controlled by the Mellon interests will remain in an advisory capacity, and G. H. Blakeley will become president.

The Shartle Bros. Machine Co., Middletown, Ohio, has purchased the Hayton Pump and Blower Co., Appleton, Wis. Removal of the plant to Middletown at once is planned. The consolidation will mean that the Shartle company will expand its output to pumps and blowers in addition to paper-making machinery.

The Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio, has received sole distributing rights in Northeastern Ohio for Diamond roller-chains, Diamond-Clark couplings and stock Diamond gear drives of the Diamond Chain & Manufacturing Co.

The Metal Textile Corporation of Canada, Ltd., a branch of the Metal Textile Corporation, Orange, N. J., has commenced operations in a plant in Hamilton, Ont. The company manufacture copper wire cleaning utensils and proposes to manufacture for export as well for the Canadian trade.

The Finn Heater Co., Ltd., has been incorporated by Ontario charter with head office at Windsor, Ont. Capital stock consists of 5,000 preference shares with a par value of $10 each and 50,000 common no par value shares. The company intends to manufacture and deal in hot water heaters, heating appliances of all kinds, and electrical apparatus.

The Whittin Machine Works, Whittinsville, Mass., has purchased the plant of the Fales & Jenks Machine Co., Pawtucket, R. I., and the Woonsocket (R. I.) Machine & Press Co., Inc.

The Pacific Iron & Metal Co. is constructing a $100,000 plant and warehouse in Seattle.

The Crescent Aircraft Co., Jersey City, N. J., has been sold to Clarence D. Chamberlin, Trans-Atlantic flyer.

Orders totaling more than $300,000 have just been placed by the Beauharnois Power Corporation for electrical equipment, structural equipment, and excavating equipment. The Steel Co. of Canada, Canadian Car & Foundry, Burlington Steel Co., Canadian General Electric, William Hamilton, Ltd., Dominion Bridge Co., and the Canadian Allis-Chalmers Co. are the recipients.

The Duriron Co., Dayton, Ohio, has its new steel foundry in full operation producing chrome-nickel and chrome-nickel-silicon alloy steels which they are adding to their line.

The partnership of Gandy & Earp, 440 South Franklin St., Decatur, Ill., has been reorganized as a corporation with $75,000 authorized capital, of which $50,000 has been paid up. C. J. Gandy is president and treasurer, L. S. Earp vice-president, and W. W. Ellison secretary.

A factory branch office of the Duriron Co., Dayton, Ohio, was opened Feb. 1 at 7-252 General Motors Bldg., Detroit. Richard R. Rourke, former sales engineer of the general office, has been appointed manager.

E. C. Atkins & Co., Indianapolis, Ind., has selected Klamath Falls, Ore., for the establishment of another branch house. A. W. Shaw, manager of the San Francisco branch, will have charge of the Klamath Falls house. J. E. Hibbert and Dave Sloan, representatives of the company in that district, will continue to represent the Atkins company as heretofore.

N. A. Strand & Co., 5001 North Lincoln St., Chicago, has appointed the Star Machinery Co., 1731-1741 First Ave., South, Seattle, Wash., as exclusive distributors in the State of Washington for Strand flexible shafts and equipments.

The Bridgeport (Conn.) Metal Goods Co. is increasing its floor space by 6,000 sq.ft., by adding a second story to one of its buildings.

Calorizing Co., 400 Hill Ave., Wilkinsburg, Pa., has awarded the contract for design and construction of a foundry and pattern storage building to the Austin Co., Cleveland. The new structure will be 96 by 132 ft., of steel frame construction and part two-story. The project represents an investment of $30,000 and will be completed the latter part of February. B. J. Sayles is president.

General contracts have been awarded for the Ford assembly plant at Seattle, Wash., which is to cost $3,000,000. Local equipment and machine tool houses anticipate inquiry for equipping this plant.

# PERSONALS

A. E. Ballin, President and Director of the McIntosh & Seymour Corporation, New York, N. Y., has retired as of Feb. 1, according to an announcement by William C. Dickerman, Chairman of the Board. R. B. McColl has been elected president and director to succeed Mr. Ballin. He was previously manager of the Schenectady plant, American Locomotive Co.

James G. Davey, formerly in charge of the Niles (Ohio) plants of the Empire Steel Corporation, Mansfield, Ohio, has been appointed general superintendent of the Canton (Ohio) Tin Plate Corporation, to succeed the late John Davey.

Harold S. Falk, Vice-President and Works Manager of the Falk Corporation, Milwaukee, has been appointed civilian aide of the Secretary of War for the Wisconsin area, to succeed the late Wheeler P. Bloodgood.

Grant Folin has been appointed sales manager of the Athol Division, Union Twist Drill Co., Athol, Mass. Mr. Folin has been connected with the Union company for many years, repre- Union company for many years.

**CLIFFORD F. MESSINGER**
**Now President and General Manager Chain Belt Company**

Harold V. Hamilton, formerly manager of the Burlington Steel Co., Ltd., Hamilton, Ont., has resigned to become general manager of the Dodge Manufacturing Co. plant in Toronto, Ont.

J. P. Keene has been elected president of the Alliance (Ohio) Tank Co. The board of the company has been reorganized and E. L. Gimmel, who for the past 25 years has been associated with the Blaw-Knox Co., Blawnox, Pa., has been named vice-president and treasurer. H. C. Koehler continues as secretary and H. H. Hunter as assistant treasurer.

W. A. Kohlhoff has been appointed sales engineer of the Hydrauger Corporation, Ltd., San Francisco. He was formerly in the gas engineering department of the Pacific Gas & Electric Co., for ten years.

J. H. Lofland, Marine Superintendent of the New York, New Haven & Hartford Railroad, New Haven, Conn., has been appointed general manager of the New England Steamship Co., with offices at Pier 14, North River, New York City.

William McFadden, formerly vice president of the Naugatuck (Conn.) Crucible Co., has joined the Bartley Crucible & Refractories Co., Trenton, N. J., in an executive capacity.

E. N. McKelvey, General Manager of the Steubenville (Ohio) works of the Wheeling (W. Va.) Steel Corporation, since 1924, resigned effective Feb. 1. F. C. Schwartz, Mr. McKelvey's assistant, has succeeded him.

Lieut.-Col. T. Sydney Morrisey has been appointed vice-president of United Engineers & Constructors (Canada). For the past six years, Col. Morrisey has been vice-president and general manager of the Combustion Engineering Corporation.

C. E. Myers, formerly superintendent of the Kuhlke Machine Co., Akron, Ohio, has organized the Akron General Machine Co., with shops and offices at 305 Water St.

Allen Nelson has been elected a director of the Logansport (Ind.) Machine Co., to succeed the late J. P. Henderson.

Fred L. Flanders, formerly chairman of the board, Muskegon (Mich.) Motors Specialties Co., subsidiary of the Houdaille-Hershey Corporation, Detroit, has been elected executive vice-president and general manager of the parent corporation.

John Reed has been appointed superintendent of the Tiffin (Ohio) plant of the Standard Sanitary Manufacturing Co., Pittsburgh, to succeed George Swinnerton, who has been made assistant engineer of the Trenton, N. J., plant.

O. C. Roberts has been appointed general manager of the Peter Smith Stamping Co., Dearborn, Mich. J. R. Winter and Z. C. Wilkinson, formerly plant executives, have resigned.

F. H. Russell has been elected president of the Manufacturers' Aircraft Association. J. Don Alexander has been elected vice-president, Walter C. Davis, secretary, C. J. Brukner, treasurer, and S. S. Bradley, assistant secretary, assistant treasurer, and general manager.

Leo P. Schaedle, formerly Pittsburgh engineer, has been appointed Midwest representative for the Alloy & Welding Manufacturing Co., Pittsburgh, with offices at 950 Dierks Bldg., Kansas City, Mo.

Lieut. T. G. W. Settle, Navy Inspector in charge of construction of the Navy Airship at Akron, Ohio, will speak on "Latest Airship Construction Development" at the Feb. 17 meeting of the Buffalo local section, A.S.M.E.

G. T. Snyder, Chief Engineer of the National Tube Co., Lorain, Ohio, has been transferred to the Engineering department at Pittsburgh.

J. Roy Tanner, formerly vice-president and general manager of the Pittsburgh (Pa.) Valve Foundry & Construction Co., has been elected president. George J. Stuart has been elected vice-president and director. He was formerly manager of production.

Albert Tencate, 85, employed continuously for 71 years by the Phoenix Iron Co., Phoenix, Pa., was recently tendered a dinner by officials of the company.

S. Wells Utley, Vice-President and General Manager of the Detroit (Mich.) Steel Casting Co., has been elected a director of the Detroit Motorbus Co., to succeed Harry S. Hall, resigned.

Raycroft Walsh, formerly vice-president and general manager of the Hamilton Standard Propeller Corporation, Homestead, Pa., has been elected president to succeed E. E. Wilson, who has resigned to devote himself to the Sikorsky Aviation Corporation, of which he is president.

Roy Wilkins has been appointed vice-president in charge of engineering of the Pacific Electric Manufacturing Co., San Francisco. Mr. Wilkins joined the organization on Jan. 1, 1928.

C. King Woodbridge has resigned as president of American Machine & Metals, Inc., but will continue on the board of directors. He will be succeeded by P. G. Mumford.

Dr. M. Luckiesh, Director of the Lighting Research Laboratory, General Electric Co., spoke on "Color in the Work World" at the Feb. 10-11 meetings of the Metropolitan Section, A.S.M.E., which was held in cooperation with the Museum of Science and Industry in the City of New York. All meetings were held in the Engineering Societies Auditorium, 29 W. 39th St.

# OBITUARIES

Terence F. Curley, 89, inventor of one of the first safety razors, died on Feb. 3 in Brooklyn, N. Y.

J. W. Kelly, 56, Pittsburgh Manager for the Jarecki Manufacturing Co., Erie, Pa., died on Feb. 1 in Pittsburgh.

J. A. Bell, President of the Capitol Steel & Iron Works, Oklahoma City, Okla., died suddenly recently.

Charles Bruning, President of the Charles Bruning Co., Inc., New York, N. Y., died on Jan. 30.

J. J. Dues, 67, President and General Manager of the Dues Machine Co., Minster, Ohio, died on Jan. 14.

Roland H. Grimm, 39, founder and owner of the Grimm Foundry Co., Manitowoc, Wis., died on Jan. 17.

Philip Kempter, 64, for many years works manager of the Geuder, Paeschke & Frey Co., Milwaukee, died on Jan. 26 after an illness of six months.

Edward W. Heath, 42, designer and manufacturer of light low-cost airplanes, crashed to his death in Chicago on Feb. 1. Mr. Heath was president of the Heath Airplane Co., and had been flying for more than 20 years.

Neal Lucey, 58, President of the Neal Lucey Co., Houston, Texas, died in Houston on Jan. 29.

Edwin R. Mack, 52, organizer with the late Austin H. Campbell of the Monarch Machinery Co., 300 North Third St., Philadelphia, Pa., in 1910, died suddenly in Germantown, Philadelphia, on Jan. 29.

Chauncy C. Place, retired, a founder of the Oswego (N. Y.) Tool Works, died in St. Petersburg, Fla., on Jan. 27.

Robert B. Smith, 65, President of the St. John River Dredging Co., and a director of the Smith Foundry Co., Ltd., Fredericton, New Brunswick, died in St. John, N. B., on Jan. 29, after a long illness.

M. A. Vanderkloot, head of the Vanderkloot Steel & Iron Co., Chicago, died in Sarasota, Fla., on Feb. 3.

R. Francis Wood, 81, formerly president of the Cambria Iron Co., forerunner of the present Johnstown, Pa., works of the Bethlehem Steel Co., died on Jan. 14 at Wayne, Pa.

Phillip A. Zinkand, 55, general machinist of the Continental Can Co., and connected with that firm for the past 25 years, died in a Syracuse hospital recently, following a brief illness.

# FORTHCOMING MEETINGS

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS — 140th annual meeting, Engineering Societies Bldg., New York, N. Y., Feb. 16-19. Headquarters, 29 West 39th St., New York, N. Y.

WESTERN METAL CONGRESS AND EXPOSITION—Second National, Civic Auditorium, San Francisco, Calif., Feb. 16-20, 1931. Under auspices of A.S.S.T. W. H. Eisenman, secretary, 7106 Euclid Ave., Cleveland, Ohio.

STEEL FOUNDER'S SOCIETY OF AMERICA—Sales clinic and regular meeting, March 19-20, Neil House, Columbus, Ohio. G. P. Rogers, Managing Director, 932 Graybar Bldg., New York City.

THREE-M-CONGRESS — Management, Maintenance, and Materials Handling Congress and Second National Industrial Equipment Exposition, Cleveland, Ohio, April 13-18, 1931. In the Arena and Exhibit Hall, Cleveland Public Auditorium. Information from the A.S.M.E., 29 West 39th St., N.Y.C.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Calvin W. Rice, executive secretary, 29 West 39th St., New York. The following meetings are scheduled:

Semi-Annual meeting, Birmingham, Ala., Apr. 20-23, 1931.

National Aeronautic Meeting, Baltimore, Md., May 12-14, 1931.

National Applied Mechanics Meeting, Purdue University, Lafayette, Ind., June 15-16.

AMERICAN FOUNDRYMEN'S ASSOCIATION—Annual convention and exhibition, Stevens Hotel, Chicago, May 4-8, 1931, C. E. Hoyt, 222 West Adams St., Chicago, secretary.

AMERICAN GEAR MANUFACTURERS' ASSOCIATION—Annual Spring Meeting, Hotel Statler, Buffalo, May 7-9, 1931. T. W. Owen, 3608 Euclid Ave., Cleveland, secretary.

NATIONAL FOREIGN TRADE COUNCIL —Annual Convention, May 27-29, at the Hotel Commodore, New York City. O. K. Davis, secretary, 1 Hanover Square, New York, N. Y.

AMERICAN MANAGEMENT ASSOCIATION—Annual Conference, Production Division, Rochester, N. Y., June 1-2, (approximate, exact dates later). Theme "Control of Manufacturing Overhead." Headquarters, 20 Vesey St., N. Y. C.

AMERICAN SOCIETY FOR TESTING MATERIALS—Annual Meeting, Stevens Hotel, Chicago, June 22-26. C. L. Warwick, 1315 Spruce St., Philadelphia, is secretary-treasurer.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Annual Summer Convention, June 22-26, Asheville, N. C. F. L. Hutchinson, 33 West 39th St., New York, N. Y., secretary.

# THE INDUSTRIAL REVIEW

**Weekly progress of the machinery and machine tool business**

## NEW YORK

Last week's statement of conditions might just as well be repeated this week. There has been little change in the situation; some dealers expect the best month since early last year, others are holding their own, still others are marking time. Little decided change is expected for the next month or two at least. Inquiry is active, but prospects are as hesitant at signing orders as they are in visiting their mothers-in-law. Navy inquiries continue, and there are rumors that some may affect the New York area shortly. Other inquiries are principally of the single tool variety. Used tool sales share the conditions.

## PHILADELPHIA

No improvement was noted in the Philadelphia area during the last two weeks. Those interviewed reported they are "living on hope" that the future will have a better story to tell than the past year has had, but there apparently was nothing in the present situation upon which that expression was based except mere hope and desire.

## CLEVELAND

The machine tool business is on a definite upward trend, according to all indications. Sales for the past ten days have increased 10 to 25 per cent over the previous fortnight while the totals since the first of the year have exceeded any of the last three months of the 1930. Inquiries too, show better form.

The Columbia Axle Company has purchased $60,000 worth of new tools for re-equipping its plant for the manufacture of free-wheeling orders for Auburn. A local dealer is low bidder on several items for the Dayton Airport list. An Akron rubber tire company has a list out for a number of tools. Westinghouse Manufacturing Company has a list out for riveting machines, drill presses, millers, and shapers for its Cleveland Works.

## CINCINNATI

Tool manufacturers have noted no change in the general situation. Selling agents state that sales remain unchanged, but that there is a slight increase in inquiries. The week's business was well scattered and the requirements were well diversified. The greater part of the orders came from general machinists and miscellaneous users, whose needs were largely confined to single tools and replacements. A fair number of single-tool inquiries were received.

## DETROIT

Detroit industry seems unquestionably on the road back to normal. Proofs of this are multiplying. Confidence has been restored, and the machinery trade reflects the new state of mind very definitely. This does not mean that dealers are becoming suddenly "bullish." It does mean however, that they are looking forward with an unusual degree of optimism to the coming months. Orders for tools and replacement equipment are being received in greater volume than at any time since November, 1929, inquiries are increasing, automobile engineers are busy, and automobile plants are steadily increasing production schedules.

One outstanding dealer reports January business several hundred per cent better than December, but attaches no great importance to this fact alone, as December was a stagnant month. He said February promises to be much better than January and has reason to believe the coming months will be still better. Employment is increasing steadily, general business is showing a constantly improving condition and there is a widespread and almost universal feeling that the corner has been turned.

**BUSINESS continues its return to normal with the alacrity of a small boy on the way to getting his neck washed. All are agreed that business must be improved, but no one seems willing to lead the way. Meanwhile, machine tool dealers and manufacturers continue their efforts to sell tools, meeting with agreement from the shopman who needs them and with sudden shyness from the man who must sign the order. Inquiry is being maintained.**

**NEW YORK'S market exhibits little change, but the month is expected to average better than last, and in some cases better than any month since early last year. Philadelphia is "living on hope," with inquiries spasmodic and the Cradle of Freedom slowing its rocking. Cleveland is more cheerful, with sales for the past ten days up 10 to 25 per cent from those of the previous fortnight, among them one for $60,000. Inquiries are good there, and more lists are in evidence. Cincinnati is just marking time. Detroit, however, shares Cleveland's enthusiasm, sales and inquiries both being well up.**

**BUFFALO reports slow, but steady, improvement. Used machinery is a little slower, but inquiries are better. Chicago is maintaining its steady improvement, demand being better from automotive sources. New England and Southern District both report steadiness, but litle improvement during the past week. Inquiries are good, some foreign orders have developed, municipal business is coming along, and the Santa Fé inquired for $15,000 worth of equipment down South. Milwaukee's outlook is better, conditions are garbled, but several good orders and inquiries have been received.**

## BUFFALO

Reports indicates that conditions are steadily, if slowly, improving. January was undoubtedly a better month by a fair margin than were either of the previous two months. Several orders, almost entirely for single pieces of equipment, have been placed during the last few weeks. There is considerable interest in used machinery, but this does not seem to be so pronounced as it was late in December and early in January.

Inquiries are more common now than at any time this year and, which is more to the point, there seems to be more actual interest back of the inquiries than usual.

Business in the electrical equipment field seems to be lagging somewhat. Even inquiries are not what they ought to be. Industrial conditions in Buffalo and immediate vicinity seem much better than those of the state outside.

## CHICAGO

Manufacturers' representatives and selling agents of machine tools are practically unanimous in declaring their business during January to have developed a distinct improvement over preceding months. In consequence, the feeling continues optimistic. The gain indicated, while not applying to every type of shop equipment, is especially noted in increased demand for high-speed drills and other tools employed largely in automotive and auto accessory plants. Inquiries for machine tools are keeping up well, and dealers specializing in used tools report inquiries fairly good, but the closing of sales slow.

## NEW ENGLAND

Last week's machine tool gains were just about maintained through the current week. Encouraging factors and bright spots were drawing enough attention to keep expressions of trade leaders fairly optimistic. Inquiries hold up well, and represent a sizable volume of future orders, unless further retrenching takes place.

A flurry of foreign orders, an inclination to close on old lists, and slight buying activity on the part of the automobile industry describes business sources. A much better tone has developed in grinding machine centers. Progress is also reported in branches of the electrical manufacturing industry. City budgets show numerous items of road machinery and manual training equipment.

## SOUTHERN DISTRICT

Machinery and machine tool business the past fortnight showed no improvement over the first two weeks of 1931. A single list was out, that of the Sante Fé railroad, involving approximately $15,000 in equipment. The materials are to be placed in the northwestern section of Texas, and interest in the business extends eastward as far as Birmingham.

Florida and points along the seaboard have been exceedingly quiet. Few new operations have originated, and no machinery and machine tool business to speak of has been reported. Some scattered sales were made through New Orleans, but points centering about the Birmingham district have been decidedly off. The month, as compared with January last year, showed up about the same to slightly better.

## MILWAUKEE

Although the outlook continues to improve, new orders being booked show a variation in volume among the various plants. Some manufacturers and dealers say that business is slow, others report that January volume was equal to the previous 3-month average, one reports that January was 100 per cent above December and about equal to last January.

Orders and inquiries continue to come from diversified sources. One manufacturer reports substantial orders for milling machines from the Westinghouse Electric & Manufacturing Co., the Columbia Axle Co., and the Jones & Laughlin Steel Co., as well as some export orders from foreign agricultural industries. Bridge-type machines feature the requirements. Another manufacturer of milling machines reports two contracts totaling about $60,000 for other types of machinery, one being an order from the Navy for hydraulic variable-speed drive equipment used in training and retracting catapults used for launching airplanes from ships, and the other variable-speed driving equipment for a paper-making machine ordered by the Eastman Kodak Co. Very litte interest is being shown locally by automotive lines.

# BUSINESS • BAROMETER

## *Confidence is returning, and with confidence business cannot be held in check much longer*

**THEODORE H. PRICE**
*Editor, Commerce and Finance, New York*

BUSINESS last week was a little more lively, although some insist that its volume is not showing the increase that had been hoped for. This may be true, but there can be no doubt that confidence is returning, and with confidence and abundant bank credit, business in the United States cannot be held in check much longer. Superficially, most of the news has been rather bearish in its implications. At 12⅞ pence per ounce in London silver declined last Thursday to a new low level for all time. Several important railways in the Middle West and Southwest have cut passenger rates to two cents a mile in an effort to meet the competition of the motor buses that are carrying so many who used to travel by rail. The cotton mill strike at Danville has been settled without a recognition of the labor union. In London the ordinary shares of one of the great British steamship companies have become almost worthless, and the news from the Lancashire cotton trade continues to be lugubrious.

In Washington the possibility of an extra session of Congress seemed imminent at one time, but the latest advices are more reassuring, and Government bonds have recovered much of the decline that was caused by the fear that the Treasury would be compelled by Congress to issue $3,500,000,000 United States bonds to be passed on to those who participate in the soldiers' bonus distribution. A compromise involving a much smaller issue for veterans in distress seems probable. In the American dry goods trade and in distributive business generally a slight improvement is reported, but it is so slight that it is difficult to be precise in regard to it.

The foregoing items are mentioned just to show the pessimistic happenings and reports that the markets have had to deal with. The fact that they have not made any substantial impression upon values is highly reassuring, and it probably marks the second stair in the upward climb that is carrying the nation back to normal. The important thing to remember is that the figures now being published reflect conditions as they were a month or more ago, and that it will take about thirty days more to gather and publish the indicia of what is now taking place.

The automobile and steel industries are both enjoying a seasonal pickup, but proceeding carefully to test out the spring demand before expanding too rapidly. Building keeps up well for this time of year. In the stock market the boom in bonds was halted for a time when an extra session and a bonus bond issue were being talked of. But short-term money rates are so much lower than the yield of good bonds that a continuing advance in the latter is indicated if the Washington storm blows itself out. If the "shindy" stirred up at Washington is not settled, and an extra session is to be called to deal with the financial condition of the Government, we may see a few months of hesitancy.

### THE BUSINESS WEEK

*February 11, 1931*

**DURING the last half of January the slight improvement evident after the turn of the year petered out. . . . Our index has been sagging for three weeks, and as the month closed it was slightly under the December low, at 76.8% of normal, by preliminary figures. . . . The January level averaged about the same as November, but a little above December. . . . January's upturn in pig-iron output—first since last April, may be another sign that the low point was passed in December. . . . But the recent slackening of the rate of improvement in steel, coal, and power production, building, car loadings, and check payments suggests how irregular, feeble, and protracted recovery is likely to be when it is left merely to the "invisible hand" and like "natural" forces within business itself, without the support and stimulation of external factors brought to bear by intelligent, courageous, and co-operative banking policies. Moreover, the steady downward drift of commodity price levels, the widening circle of debt repudiations or moratoria, the increasing political chaos, and conflict precipitated by group resistance to deflation, show that the mere postponement of recovery is not the worst danger in the blind acceptance of this process. . . . Sooner or later it must be checked by deliberate effort.**

©The Business Week

There is, however, no denying that the country is now in a better condition than it was, and that business may reach a point at which it will become immune to further doses of pessimism.

In Europe things seem to be tranquil, and a summer of comparative quietude is indicated. The earthquake in New Zealand, the political and financial condition in Australia and Great Britain, and the announcement that the Soviet Government of Russia had agreed not to dump the surplus of its production in Great Britain are items in the foreign news that have attracted wide attention. The convention between the Soviet Government and Great Britain has created something of a sensation in many quarters where it was not known that Russia and England were getting together.

As the edge is just a little off the bond market in the United States, it is not surprising that the stock market has also been slack, but no decline of importance has been registered nor is any likely unless money becomes scarcer and loans are harder to obtain.

Wheat and other grains are all somewhat better. The talk is of dry weather and other conditions unfavorable to agriculture, and Mr. Legge states that last year's drought has not yet been effectively broken. This may be a matter of importance later in the year.

The outlook is, in fact, remarkably cheerful when present conditions are considered, and it is quite possible that an advance in the price of life's necessaries will soon be seen.

Theoretically, it is very easy to interpret conditions bearishly, but the bearish traders who go short of what society requires for food, raiment, and shelter will probably find it very difficult to recover the goods they have sold, as each decline seems to reveal an unexpectedly large demand.

If the decline in silver could be arrested, a marked revival of Oriental trade would probably be seen. In Great Britain and the United States the maladjustment of the gold supply is the thing complained of. In India and China it is the demonetization of silver that is talked of. Both phrases come to nearly the same thing, and it is plain that in the Orient as well as in the Occident the stabilization of monetary values would greatly help the situation.

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# THE WEEKLY PRICE GUIDE . . . .

### *Rise and Fall of the Market*

NON-FERROUS metals, after a very slight improvement last week, have again slumped back. Fabricated brass and copper are off 1c. per lb. in all important centers. Scrap has weakened accordingly. Zinc, the last of this group to weaken, is still at 4.05c., E. St. Louis; lead is down 0.25c., to 4.30. The prices of tin and babbitt metal have been strengthened by reports of curtailed exports from producing districts. Steel does not show the improvement expected, although current orders for line pipe, automotive material, tin plate, rails and track accessories keep it from sagging further. Prices of steel products are steady, perhaps because untested.

*(All prices as of Feb. 6, 1931)*

## IRON AND STEEL

**PIG IRON**—Per gross ton, f.o.b.:

| | |
|---|---|
| CINCINNATI: | |
| Ala. Foundry (Silicon, 1.75@2.25) | $14.19@$14.69 |
| Tenn. Foundry (Silicon, 1.75@2.25) | 14.19@ 14.69 |
| NEW YORK: | |
| Buffalo No. 2 Fdry. (Silicon, 1.75@2.25) | 20.41@ 20.91 |
| BIRMINGHAM: | |
| No. 2 Foundry (Silicon 1.75@2.25) | 13.00@14.00 |
| PHILADELPHIA: | |
| Eastern Pa., No. 2x (Silicon, 2.25@2.75) | 18.26@ 19.26 |
| Virginia No. 2 (Silicon, 1.75@2.25) | 22.29 |
| Basic | 17.25@ 17.50 |
| CHICAGO: | |
| No. 2 Foundry, Northern (Silicon, 1.75@2.25) | 17.50 |
| No. 2 Foundry, Southern | 17.51 |
| PITTSBURGH: (including freight charge, $1.76, from Valley) | |
| No. 2 Foundry | 18.76 |
| Basic | 18.76 |
| Bessemer | 19.26 |

**IRON MACHINERY CASTINGS**—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

| | |
|---|---|
| Detroit | 4.00 |
| Cleveland | 4.75 |
| Cincinnati | 4.45 |
| New York | 4 75@5.00 |
| Chicago | 4.50@4.75 |

**SHEETS**—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

| Blue Annealed* | Pittsburgh Mill Base | Chicago | Cleveland | New York |
|---|---|---|---|---|
| No. 10 | 1.90 | 3.35† | 3.00 | 3.25† |
| No. 12 | 1.95 | 3.45† | 3.10 | 3.30† |
| No. 14 | 2.05 | 3.55† | 3.20 | 3.35† |
| No. 16 | 2.15 | 3.65† | 3.30 | 3.45† |
| Black | | | | |
| Nos. 18 to 20 | 2.15@2.25 | 3.60† | 3.40 | 3.30 |
| No. 22 | 2.30@2.40 | 3.75† | 3.55 | 3.45 |
| No. 24 | 2.35@2.45 | 3.80† | 3.60 | 3.50 |
| No. 26 | 2.45@2.55 | 3.90† | 3.70 | 3.60 |
| No. 28 | 2.60@2.70 | 4.05† | 3.85 | 3.75 |
| Galvanized | | | | |
| No. 10 | 2.20@2.30 | 3.65† | 3.50 | 3.35 |
| Nos. 12 to 14 | 2.30@2.40 | 3.75† | 3.60 | 3.40 |
| No. 16 | 2.40@2.50 | 3.85† | 3.70 | 3.50 |
| No. 18 | 2.55@2.65 | 4.00† | 3.85 | 3.65 |
| No. 20 | 2.70@2.80 | 4.15† | 4.00 | 3.80 |
| No. 22 | 2.75@2.85 | 4.20† | 4.05 | 3.85 |
| No. 24 | 2.90@3.00 | 4.35† | 4.20 | 4.00 |
| No. 26 | 3.15@3.25 | 4.60† | 4.35 | 4.25 |
| No. 28 | 3.40@3.50 | 4.85† | 4.70 | 4.50 |

*Light Plates. †400 to 3,999 lb.

**WELDED STEEL PIPE**—Warehouse discounts are as follows:

| | New York | | Cleveland | | Chicago | |
|---|---|---|---|---|---|---|
| | Black | Galv. | Black | Galv. | Black | Galv. |
| 1 to 3 in. butt.. | 56.14% | 43.6% | 53.3% | 42.3% | 57.3% | 44.8% |
| 3½ to 6 in. lap.. | 52.72% | 40.18% | 50.8% | 37.8% | 53.9% | 41.4% |

WROUGHT-STEEL PIPE LIST

| Size, Inches | List Price per Foot | Diameter in Inches—External | Diameter in Inches—Internal | Thickness Inches |
|---|---|---|---|---|
| 1 | $0.17 | 1.315 | 1.049 | .133 |
| 1¼ | .23 | 1.66 | 1.38 | .14 |
| 1½ | .27½ | 1.9 | 1.61 | .145 |
| 2 | .37 | 2.375 | 2.067 | .154 |
| 2½ | .58½ | 2.875 | 2.469 | .203 |
| 3 | .76½ | 3.5 | 3.068 | .216 |
| 3½ | .92 | 4.0 | 3.548 | .226 |
| 4 | 1.09 | 4.5 | 4.026 | .237 |
| 5 | 1.48 | 5.563 | 5.047 | .258 |
| 6 | 1.92 | 6.625 | 6.065 | .28 |
| 8 | 2.50 | 8.625 | 8.071 | .277 |

**SEAMLESS STEEL TUBING**—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

| Thickness—Decimal | B.w.g. and Fractions | Outside Diameter in Inches—⅛ | ¼ | ⅜ | ½ | ⅝ | ¾ | 1 | 1¼ | 1½ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Price per Foot— | | | | | | | | |
| .035" | 20 | $0.15 | $0.16 | $0.17 | $0.18 | $0.19 | $0.21 | $0.23 | | |
| .049" | 18 | .17 | .18 | .19 | .20 | .21 | .23 | .25 | | |
| .065" | 16 | .19 | .20 | .21 | .22 | .23 | .25 | .27 | | |
| .083" | 14 | .20 | .22 | .23 | .24 | .25 | .27 | .29 | | |
| .095" | 13 | .21 | .23 | .25 | .26 | .27 | .29 | .31 | | |
| .109" | 12 | .22 | .24 | .26 | .27 | .28 | .30 | .32 | | |
| .120" or .125" | 11 | .23 | .25 | .27 | .28 | .29 | .31 | .33 | | |
| .134" | 10 | .24 | .26 | .28 | .29 | .30 | .32 | .34 | | |

**MISCELLANEOUS**—Warehouse base prices in cents per lb.:

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Spring steel, light* | 4.50 | 4.65 | 4.65 |
| Spring steel, heavier | 4.00 | 4.00 | 4.00 |
| Coppered Bessemer rods | 7.00 | 6.00 | 6.15 |
| Hoop steel | 3.75† | 4.00 | 3.75† |
| Cold rolled strip steel | 4.95 | 6.00 | 6.10 |
| Floor plates | 4.85† | 5.30 | 5.00† |
| Cold fin., round or hexagon‡ | 3.40 | 3.65 | 3.35 |
| Cold fin,, flat or square‡ | 3.90 | 4.15 | 3.85 |
| Structural shapes | 3.10† | 2.95 | 3.00† |
| Soft steel bars | 3.10† | 2.95 | 3.00† |
| Soft steel bar shapes | 3.10† | 2.95 | 3.00† |
| Soft steel bands | 3.40† | 3.20 | 3.20† |
| Tank plates | 3.10† | 3.00 | 3.00† |
| Bar iron (2.75 at mill) | 3.24 | 3.00 | 3.00 |
| Drill rod (from list) | 65% | 55% | 50% |

*Flat, $\frac{3}{16}$-in. thick by ¾-in. wide. †400 to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire at New York warehouse—$\frac{3}{32}$, 8.35c. per lb.; ⅛, 7.85c. per lb.; $\frac{5}{32}$ to ½, 7.35c. per lb.

## METALS

Warehouse Delivery Prices in Cents Per Lb. for Small Lots:

| | | | |
|---|---|---|---|
| Copper, electrolytic, New York | | | 11.00@11.50 |
| Tin, Straits, pigs, New York | | | 29.00@30.00 |
| Lead, pigs, E. St. Louis | 4.30 | New York | 5.87½ @6.87½ |
| Zinc, slabs, E. St. Louis | 4.05 | New York | 5.50 @ 6.50 |

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Antimony, slabs | 10.00@10.50 | 10.50 | 10.75 |
| Copper sheets* | 19.50 | 19.50 | 19.50 |
| Copper wire* | 11.50 | 11.75 | 11.62½ |
| Copper, drawn, round* | 18.00 | 18.50 | 18.00 |
| Copper tubing* | 21.87½ | 21.87½ | 21.87½ |
| Brass sheets, high* | 16.87½ | 16.87½ | 16.87½ |
| Brass tubing, high* | 21.75 | 21.75 | 21.75 |
| Brass rods, high* | 15.12½ | 15.12½ | 15.12½ |
| Brass wire, high* | 17.37½ | 17.37½ | 17.37½ |

*Mill, base.

# SHOP MATERIALS AND SUPPLIES

## METALS—Continued

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Aluminum ingots, 99%† | 24.00@25.00 | 24.30 | 23.30 |
| Zinc sheets (casks) | 9.75@10.25 | 11.25 | 10.36 |
| Solder (½ and ½) | 22.00 | 21.50 | 18@20 |

Babbitt metal, delivered in case lots, New York, cents per lb.:

| | |
|---|---|
| Genuine, highest grade | 45.50 |
| Commercial genuine, intermediate grade | 34.50 |
| Anti-friction metal, general service | 29.00 |
| No. 4 babbitt, f.o.b. | 10.00 |

†F.O.B.

**NICKEL AND MONEL METAL**—Price in cents per lb., base, f.o.b. Huntington, W. Va.:

| | Nickel | Monel Metal |
|---|---|---|
| Sheets, full finished | 52.00 | 42.00 |
| Sheets, cold rolled | 60.00 | 50.00 |
| Strip, cold rolled | 55.00 | 45.00 |
| Rods, hot rolled | 45.00 | 35.00 |
| Rods, cold drawn | 50.00 | 40.00 |
| Tubing | 75.00* | 90.00† |
| Angles, hot rolled | 50.00 | 40.00 |
| Plates | 52.00 | 42.00 |

*Seamless. †Welded

**OLD METALS**—Dealers' purchasing prices in cents per pound, f.o.b. cars:

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Crucible copper | 7.75 | 7.75 | 7.25@ 7.75 |
| Copper, heavy, and wire | 7.50 | 7.50 | 6.75@ 7.25 |
| Copper, light, and bottoms | 6.75 | 6.50 | 6.00@ 6.50 |
| Heavy lead | 3.50 | 3.50 | 3.00@ 3.50 |
| Lead battery plates | 1.50 | 2.50 | 2.00@ 2.50 |
| Brass, heavy, yellow | 4.50 | 4.50 | 4.00@ 4.50 |
| Brass, heavy, red | 6.75 | 7.00 | 6.25@ 6.75 |
| Brass, light | 3.50 | 3.25 | 3.50@ 4.00 |
| No. 1 rod-brass turnings | 4.75 | 4.50 | 4.25@ 4.75 |
| Zinc | 1.50 | 1.50 | 1.25@ 1.50 |

**TIN PLATES**—Charcoal—Bright—Per box:

| "AAA" Grade: | New York | Cleveland | Chicago |
|---|---|---|---|
| IC, 14x20 | $12.10 | $11.95 | $11.50 |
| "A" Grade: | | | |
| IC, 14x20 | 9.70 | 9.90 | 9.50 |
| Coke Plates—Primes—Per box: | | | |
| 100-lb., 14x20 | 6.45 | 6.10 | 7.00 |
| Terne Plates—8-lb. Coating—Small lots—Per box: | | | |
| IC, 14x20 | 7.75@8.00 | 7.00 | 7.50 |

## MISCELLANEOUS

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Cotton waste, white, per lb. | $0.13 | $0.16 | $0.15 |
| Cotton waste, colored, per lb. | .09½ | .12 | .10 |
| Wiping cloths, washed, white, per lb. | .15 | 38.00 per M | .14½ |
| Sal soda, per lb. | .01½ | .02 | .02 |
| Roll sulphur, per lb. | .028 | .03 | .04 |
| Linseed oil, raw, in 1 to 4 bbl. lots, per lb. | .096 | .099 | .098 |
| Cutting oil, about 25% lard, in 5 gal. cans, per gal. | .75 | .60 | .60 |
| Machine oil, medium-bodied (55 gal. steel bbl.) per gal. | .33 | .36 | .24 |
| Belting—Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber: | | | |
| Leather—List price, 24c. per lin.ft., per inch of width, for single ply: | | | |
| Medium grade | 30–10% | 30–10% | 50% |
| Med. grade, heavy wgt. | 30% | 30 –5% | 40% |
| Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.: | | | |
| First grade | 70% | 50–10% | 60% |
| Second grade | 65–5% | 60– 5% | 65% |

## *Comparative Warehouse Prices*

| New York | Unit | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|---|
| Soft steel bars | per lb. | $0.031 | $0.031 | $0.0325 |
| Cold fin. shafting | per lb. | .034 | .034 | .035 |
| Brass rods | per lb. | .1512½ | .1612½ | .2125 |
| Solder (½ and ½) | per lb. | .22 | .215 | .2975 |
| Cotton waste, white | per lb. | .13 | .13 | .13 |
| Disks, aluminum oxide mineral, cloth, No. 1 6-in. dia. | per 100 | 4.59 | 4.59 | 4.59 |
| Lard cutting oil | per gal. | .75 | .65 | .65 |
| Machine oil | per gal. | .33 | .33 | .33 |
| Belting, leather, medium | off list | 30–10% | 30–10% | 30–10% |
| Machine bolts, up to 1x30 in., full kegs | off list | 65–10% | 65% | 50–10% |

## MISCELLANEOUS—Continued

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets: | | | |
| Flint paper* | $6.03 | $6.03 | $6.03 |
| Emery cloth* | 25.87 | 25.87 | 25.87 |
| Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100: | | | |
| Paper† | 2.61 | 2.61 | 2.61 |
| Cloth† | 4.59 | 4.59 | 4.59 |
| Fire clay, per 100 lb. bag | 1.00 | .75 | .75 |
| Coke, prompt furnace, per net ton | Connellsville, 2.40@2.50 | | |
| Coke, prompt foundry, per net ton | Connellsville, 3.25@4.85 | | |
| White lead, dry | 100 lb. kegs | New York, 13.25 | |
| White lead, in oil | 100 lb. kegs | New York, 13.25 | |
| Red lead, dry | 100 lb. kegs | New York, 13.25 | |
| Red lead, in oil | 100 lb. kegs | New York, 14.75 | |

*Less than 3 reams. †Less than 200.

## SHOP SUPPLIES

Discounts from latest list, dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

| | |
|---|---|
| Machine bolts: | |
| Up to ¾-in. x 6-in., full kegs, list less | 65–10% |
| Larger, up to 1 x 30-in., full kegs, list less | 65–10% |
| Less than full kegs or case lots, add to list | 10% |
| Fitting-up bolts: list less | 45% |
| Lag screws: | |
| Up to ½-in. x 6-in., list less | 65–10% |
| Larger, list less | 65–10% |
| Less than full keg or case lots, add to list | 10% |
| Rivets: | |
| Structural, round head, full kegs, net | $4.25 |
| Structural, round head, broken kegs, net | 5.75 |
| Tank, 7/16-in. dia. and smaller, list less | 60–10% |
| Nuts: | |
| Hot pressed, square or hexagonal, blank or tapped: | |
| Full kegs up to 1-in., incl., list less | 65–10% |
| Larger, up to 3-in., list less | 65–10% |
| Less than keg or case lots, add to list | 10% |
| Washers: | |
| Wrought, full kegs, per 100 lb., list less | $3.50 |
| Wrought, broken kegs, per 100 lb., list less | 1.50 |
| Turnbuckles: | |
| With stub ends, list less | 20–10% |
| Without stub ends, list less | 55% |
| Chain: | |
| Proof coil, base, per 100 lb., net | $8.50 |
| Cast iron welding flux, per lb., net | .35 |
| Bronzing flux, per lb., net | .50 |

# MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

## Equipment Wanted

**Mass., Dover**—E. F. Hodgson—8 ft. power sheet metal workers shears.

**Mass., Charlestown**—Warren Co., 186 Main St.—power pipe cutting machine.

**Mo., Robertson** — Bureau of Supplies & Accounts, Navy Dept., Washington, D. C.—will receive bids until Feb. 17 for woodworking machine at Naval Reserve Aviation Base here.

## Opportunities for Future Business

**Calif., Los Angeles**—Saf-T-Pak Filler Corp., is having plans prepared for a 1 story factory for the manufacture of composition products. Estimated cost $70,000.

**Calif., Ontario** — Edison Electric Appliance Co., 5600 Taylor St., Chicago, Ill., plans the construction of a plant for the manufacture of electric ranges here. Estimated cost $250,000.

**Calif., Redwood City**—Pacific Gas & Electric Co., 445 Market St., San Francisco, awarded contract for the construction of a group of service buildings, including shops, etc., here. Estimated cost $40,000.

**Ill., Bellville**—Peerless Enameling & Stamping Co., R. G. Willman, Secy., awarded contract for a 1 story, 110 x 120 ft. addition to factory at 1500 West Lincoln St.

**Ind., Lebanon**—Sinclair Oil Co., awarded contract for the construction of a service station at Main St. and Indianapolis Ave. Estimated cost $43,000.

**Ind., South Bend** — Goodrich Rubber Co., Main St., Akron, O., awarded contract for the construction of a service station at Lafayette and Colfox Sts. Estimated cost $40,000.

**Ky., Covington** — Covington & Cincinnati Bridge Co., Second and Greenup Sts., awarded contract for a 3 story automobile repair and service building. Estimated cost $125,000.

**Me., Bangor**—Bangor & Aroostook Railroad Co., plans to rebuild part of engine house, including shop at Presque Isle, recently destroyed by fire.

**Md., Baltimore** — Crown Cork & Seal Co., Eastern Ave. and Kresson St., had plans prepared for extensions and improvements to plant to include machine shop, distribution plant, etc., for the manufacture of bottle caps, bottle sealing machinery and parts.

**Mass., Belmont** — Electric Light Dept., Concord Ave., plans the construction of a 1 story, 50 x 110 ft. garage, etc., on Waverly Ave. Estimated cost $45,000. Private plans.

**Mass., Boston**—Park Dept., 33 Beacon St., will soon award contract for alterations to service building at Back Bay service yard, Audubon Rd. Estimated cost $25,000. Private plans.

**Mass., Springfield**—City, W. H. Daggett, Fire Chief, Court St., plans the construction of a signal station and repair shop on State St. Estimated cost $40,000. Architect not selected.

**Mich., Detroit** — Detroit Gray Iron Foundry Co., Iron and Wight Sts., awarded contract for a 2 story, 75 x 160 ft. addition to foundry. Estimated cost $100,000. Noted Jan. 22.

**N. J., East Rutherford** — East Rutherford Syringe Co., 75 Mozart St., is having revised plans prepared for the construction of a 2 story factory at 54 Mozart St. Estimated cost $40,000. Architect not announced. Noted Aug. 21.

**N. J., Elizabeth**—Service Machine Co., Inc., 158 Miller St., awarded contract for a 2 story, 50 x 60 ft. addition to plant.

**N. J., Jersey City** — B. Singer, 921 Bergen Ave., Archt., will receive bids about Mar. 15 for the construction of a 2 story, 45 x 140 ft. factory on Crawford St. for Jersey City Ladder Co., 677 Montgomery St. Estimated cost $50,000. Noted Jan. 22.

**N. J., Metuchen**—Owner, c/o A. M. Korff, 203 Park Ave., Plainfield, Archt., plans the construction of a bus terminal here. Estimated cost $150,000.

**N. J., Newark** — Unique Art Mfg. Co., 196 Waverly Ave., is having plans prepared for a 2 story addition to factory. Estimated cost $40,000. S. Shew & Co., 24 Commerce St., Archts. and Engrs.

**N. J., Ogdensburg** — W. E. Griffiths, c/o Ramp Building Corp., 21 East 40th St., New York, N. Y., Archts., will not construct service garage here. $100,000. Project abandoned. Noted June 5, 1930.

**N. J., Paterson**—City Planning Commission, B. H. Saunders, City Hall, will not construct garage building on Straight St. $150,000. Project abandoned. Noted Jan. 30, 1930.

**N. J., Ridgefield**—Lowe Paper Co., River Rd., awarded contract for a 2 story, 100 x 160 ft. lithograph shop. Estimated cost $50,000. Noted Jan. 29.

**N. J., Trenton** — Panelyte Corp., Enterprise Ave., awarded contract for a 1 story, 50 x 160 ft. addition to plant for the manufacture of paperboard insulation panels, automobile panels, etc. Estimated cost $40,000.

**N. Y., Jamaica**—Branhill Realty Co., 163-18 Jamaica Ave., is having sketches made for a 114 x 136 ft. service garage at Archer Ave. and Standard Pl. Estimated cost $50,000. M. Klein, 65 Court St., Brooklyn, Archt.

**N. Y., Jamaica** — Hyman's New York & Jamaica Express, 145-01 101st Ave., is having sketches made for a 100 x 200 ft. service garage and shop at 165th St. and Jamaica Ave. Estimated cost $40,000. T. Guterman, 16 Nassau St., Brooklyn, Archt.

**N. Y., Maspeth**—Jones & Larsen, 58-61 55th St., will build a 99 x 100 ft. steel shop including equipment at Furman Ave. and Grand St. Estimated cost $40,000. Private plans. Work will be done by day labor and separate contracts.

**N. Y., Northport**—Long Island Lighting Co., Woodbine Ave., is having plans prepared for the construction of an industrial warehouse. Estimated cost to exceed $75,000. Private plans. Maturity about May 1 or later.

**N. Y., Richmond Hill**—Metz Auto Sales & Laundry, 127-15 Metropolitan Ave., will receive bids about April 1 for the construction of a service garage at Metropolitan Ave. and 129th St. Estimated cost $50,000.

**N. Y., Syracuse** — Niagara Hudson Power Corp., Hiawatha Blvd., plans the construction of a 2 story, 100 x 200 ft. garage. Estimated cost $100,000. Bley & Lyman, 505 Delaware St., Archts.

**N. Y., White Plains** — Jasamore Realty Co., S. M. Salke, 489 5th Ave., New York, plans the construction of a 3 story, 50 x 175 ft. service garage at 85 South Lexington Ave. here. Estimated cost $100,000. Work will be done by separate contracts. Maturity about April or later. Noted Oct. 9.

**Pa., Conshohocken** — Ford & Kendig, 1428 Callowhill St., Philadelphia, manufacturers of steam heating equipment, is having revised plans prepared for a 1 story, 75 x 360 ft. pipe shop, storage and distribution plant, etc., here. Estimated cost $100,000.

**Pa., Pittsburgh**—E. G. Hartje, 5622 Aylesboro St., is receiving bids for the construction of a 1 story, 37 x 72 ft. service building at 4900 Baum Blvd. Estimated cost $40,000. R. M. Reutti, Whitfield Bldg., Archt.

**R. I., Providence**—M. Gordon, Hospital Trust Bldg., will build a 1 story, 80 x 180 ft. repair garage and service station at 34-36 Branch Ave. Estimated cost $50,000. H. W. Castor, St. Girard Bldg., Philadelphia, Pa., Archt. Work will be done by separate contracts.

**Wis., Sparta** — Monroe County Board, plans the construction of an equipment for addition to county machine shop and service building. Estimated cost $20,000.

**Ont., North Bay**—William Kennedy & Sons, Ltd., is having plans prepared for a 1 and 2 story iron foundry and machine shop. Estimated cost $50,000, here. Private plans. Noted Jan. 22.

**Que., St. Hyacinthe**—Corp., c/o U. H. Dandurand, 414 St. James St. W., Montreal, Pres., will soon receive bids for a 3 story 150 x 900 ft. garage. Estimated cost $1,500,000. Ross & Macdonald, 601 Belmont St., Montreal, Archts.


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The Agent—
The Seller—
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